AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Craig Sight-Feed Lubricator.

The large cut represents this lubricator as made for use on locomotive engines. It is secured to the boiler head or cab casting by means of a bracket, and connection is made to the right and left hand steam chests respectively, by means of the so-called tallow pipes running beneath the jacket. Steam is taken from the boiler to furnish condensation. By removing the valves from pipes over steam chests, communication is opened between the cup and valves where pressure is secured when using steam, and by a simple device a small quantity of steam is also had to carry oil to the valves after steam has been shut off; the oil being introduced into these steam pipes becomes atomized, forming a steam lubricant which comes in contact with every part of the valves and cylinders reached by steam. This manner of attachment secures independent lubrication to each steam chest and cylinder from the one cup, which can be regulated to feed fast or slow.

The rate of feed to each cylinder is regulated and shown in drops through one glass window. This window also shows when the cup needs filling with oil.

The cup is opened on and closed off from the cylinders by the simple movement of a lever, thus preventing the steam chests becoming filled with steam when the engine is at rest. This is very important, as it makes the lubricator perfectly practical on engines making short runs or making up trains, etc., the adjustment of the feed valves remaining the same.

The feed is regular and continuous going up or down grade, whether pressure is on or off, thus securing perfect lubrication at all times. From their construction and location they will not freeze, and are said not to be affected by changes of temperature.

The valve and cylinder cup is supplied with valve (*B*), which may be used as hand oilers in case of breakage of gauge or sight feed glass. The oil and steam passages are drilled through a column cast through the center of the oil reservoir, preventing the possibility of leakage from joints that may be strained or poorly made.

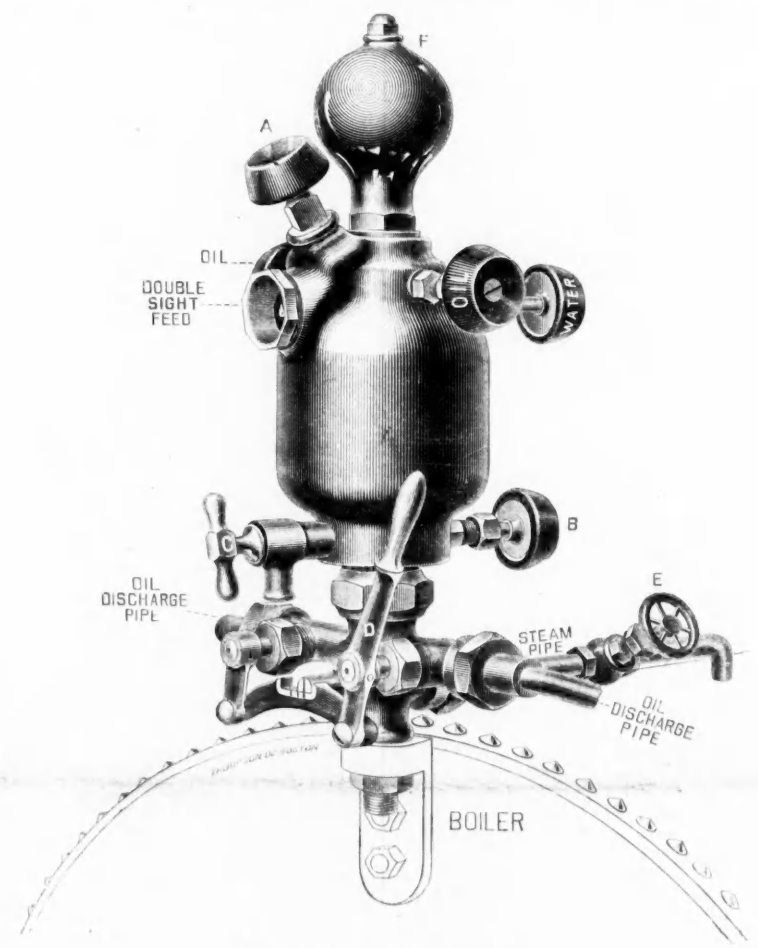
Each lubricator is furnished with a lead disk, the diameter and thickness of the glass, so if the glass breaks, and the engineer has not a spare one, he can put in the lead disk, and if he has become used to running the cup, no trouble will be experienced in using it as a blind feed until another glass can be obtained, or, by the use of valve *B*, it can be used as a hand oiler, as before stated.

The following description has reference to the letters on the engraving.

Steam pipe attached to top of boiler, *E*, valve to close off steam, oil discharge pipes leading to each cylinder. *D*, lever to open and close discharge pipes, shown in cut as open. The center mark on link and stop, when together, brings the discharge valves half open, the third mark just commencing to open; when closed the valves lap and are perfectly tight. *B*, valve to use as a hand oiler when the glass breaks; it oils both ways at once. The cup may be drained through this valve if desired. *C*, is outside drain cock, also used when blowing steam through the cup. *A*, filling plug. *F*, condenser water valve, leads from the condenser to both sides of the oil reservoir. Valves marked oil are the regulating valves. The glass marked double-sight feed shows the rate of feed to each cylinder, as regulated by the oil valves.

The small engraving, page 2, represents the lubricator, especially adapted to locomotive air pumps, in which *A* is the filling plug; *B*, water valve; *C*, condenser; *D*, oil valve, and *E*, drain cock.

The Craig Sight Feed Lubricating Company, Lawrence, Mass., have recently added the manufacture of these two styles to their other goods in this line.



CRAIG SIGHT-FEED LUBRICATOR.

New High-Speed Automatic Engine.

The engraving represents a new automatic high-speed engine, recently brought out by the Weston Engine Company, Painted Post, Steuben County, N. Y., who have for some time been making a 5-horse portable engine of same general design.

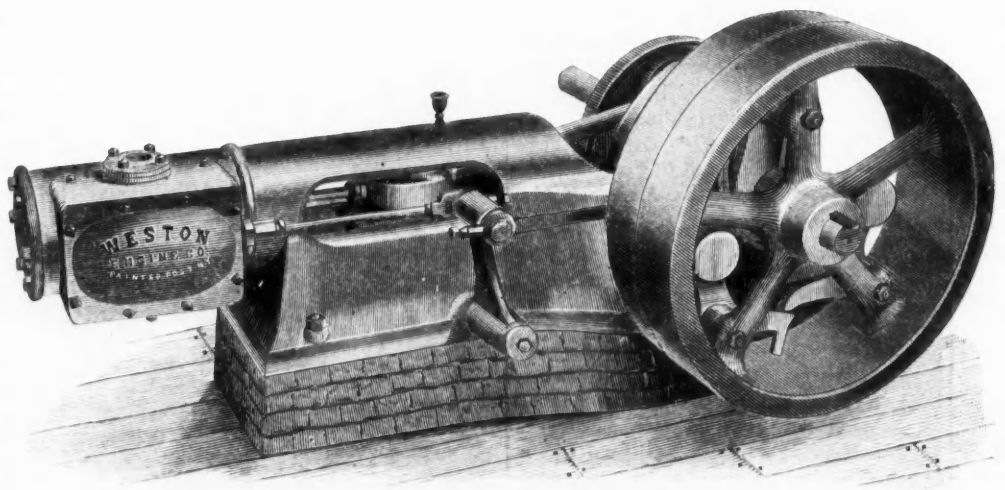
The engine represented is a 6″x10″, weighing 2,600 lbs. It has balanced slide-valve; fly-wheel pulley 33″ diameter, 11″ face; crank shafts are of steel, 3″ diameter, with bearings 8″ long; crosshead bearings are 11″ long, 5″ wide; crankpin 3″ diameter, 4½″ long; connecting-rod of steel.

Scraped joints take the place of packing, except for piston-rod and valve-rod. Counterbalance in crank is equal to weight of reciprocating parts.

The running parts can be oiled when in motion by a common oil can.

Cylinder and head are air-jacketed.

The steam ports are large, and steam is admitted through a double opening, giving high initial pressure at rapid speed.



THE WESTON HIGH-SPEED AUTOMATIC ENGINE.

About Water-Wheels—Division of Motive Plant—The Machinist in the Wheel Pit.

BY JAMES F. HOBART.

Where are all the water-wheels? Everybody tells about his steam engine, how it bothered him, and how he fixed it, but we don't hear from a water-wheel once in two years.

They are not idle, even if they are not heard from; and the millwright, machinist, or M. E., who has to crawl into a wheel pit on some December Sunday, makes noise enough to supply the deficiency.

The old overshot wheels have almost disappeared, and peace be to their remains. They were awful good wheels to economize water, and awful poor wheels to keep in repair. They were the only wheels that gave good results with ¼ partial gate. Take the best turbine in the market, even one that develops 85 per cent. of the power of the water, and when you want to run one or two machines and save water by using a partial gate, then you get left right off. The 85 per cent. don't come along at half gate, and neither does the 50 per cent., and often 40 per cent. stays away with them.

There is just one way by which we can overcome this trouble and get good results from a little water with a turbine wheel. We must put in small wheels and connect to the machines to be driven. A few years since, most M. E.'s got into the notion of connecting all the machinery in a mill to one big shaft, and then driving said shaft by one or two big water-wheels or steam engines. The M. E.'s are afflicted with fashions just exactly as the ladies are, and we will admit that the former's fashions are much more costly.

When a new idea comes up, then everybody must use that idea for everything. He must ride the hobby to death before he finds out just what it is really good for, and after he has done a thing, seen it fail, and then reconstructed it according to common sense, then that chap knows what his fashionable idea was good for.

The one-water-wheel fashion is fast playing out, and the one-steam-engine idea is going out with it. Everybody will want a water-wheel or an engine for each separate machine in the future. It is probable that this division of motive power will be carried to the same ridiculous extreme that the consolidation scheme attained, but for small and variable water power this method is the best known to practice. When a man gets to figuring up the per cent. of his water power which is actually converted into work, and finds the same away down in the lower edge of the twenties, then he is apt to get to thinking about the hundred tons of 5″, 6″ and 7″ shafting that he is driving day after day.

When something happens to his water-wheel, and his whole mill stands still two days for repairs, then he wishes that his 300 horse-power water-wheel was broken up into ten smaller ones. He might have ten times as many breaks, but they would delay only $\frac{1}{10}$ of his plant.

The steam engine men have found it out too. We will not have another monstrous engine built to drive all the machinery of a centennial exhibition. Instead of one, there will be dozens of small ones employed to do the same work.

When a man buys a water wheel, he should buy the best one in the market, and when he selects that one, then he has done a thing which we don't know how to do.

Just advertise for the best water-wheel made, and you are answered by 392 men, each and every one ready to take oath that their wheel is the one which you want. You are confronted with wheels that are almost too simple in their construction, while other wheels are so complex and complicated that the water must be filtered, and almost needs steaming and bending, to enable it to get through the intricate passages.

Wheels with scroll cases are shown you, and they are good ones, generally speaking, but the man who sells another kind of a wheel says the scroll-case wheel "will wear its step down stream." It will too, if it is not balanced, and put true upon a straight shaft. Perhaps Tom turned the shaft too small, or bored the wheel a "trifle large," then the wheel will run out of truth. Perhaps he sprung the shaft when he keyed on the wheel. This made a crank of the water-wheel shaft, and the up stream side of that step has to stand the music.

When this crank business occurs in a wheel which takes water through chutes all around its circumference, then the step must go just as surely, but it goes from all sides at once, and wears out very much faster than with the scroll case.

Sometimes a wheel is set in a decked flume, and then condemned because it don't come up to the expectations of the purchaser. More than once this has happened, and the trouble has all been found in the flume. The shaft passed out through a stuffing-box which was bolted firmly to the deck timbers and planking. The wheel didn't give 50 per cent. of the power expected. An investigation disclosed the fact that one corner of the flume settled when it was filled with water, and the shaft was drawn out of line $2\frac{1}{2}$" thereby.

We don't want any of our water-wheels placed in a $4' \times 6'$ box. We want them where we can get at them when they need repairs. Give us a water-wheel in a nice cast-iron case outside of the flume, and then it can be overhauled without much trouble.

The old frame flume is a thing of the past. We will have none of it. It takes up lots of room, and when it gets to leaking, it is worse than ten leaky roofs. Give us an old boiler shell for a penstock. That is what all old boilers are fit for, with one exception, and that exception is to use the old boilers for piers under buildings or bridges.

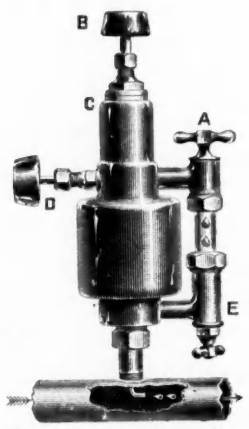
Patch up an old boiler so it will be water tight, then place it on end in position under building or bridge. Now go to work and fill with cobble-stones, brick-bats, or any stone that will go into it. Pour in thin cement as you fill up. When the concern gets solid you will, if it is properly anchored top and bottom, have a pier which will stand much trouble. Fifty or sixty feet can be easily covered by uniting together a number of old shells not less than 48 inches in diameter.

These old shells make splendid penstocks; they are pretty safe there, for they seldom are troubled with low water when used for this purpose, and the fireman never gets a shadow of an excuse to swear he had two gauges of water when the plates got "melted" out.

Somebody has been illustrating in the papers this use for old boilers, but they don't tell one-half the things that are possible in this line. Keep the flume out of the mill. Run the old boiler to the canal or river and do away with the nasty, rotten, homely, in-the-way flume.

We like to get a machinist into a wheel pit. He will climb down the ladder with a spline in one hand, his hammer in the other, and four followers, a piece of waste and a plug of tobacco in his breeches pocket. The first thing he does is to wipe a place whereon to lay his hammer, and then he will wait for somebody to begin. There is a big gear to go on a shaft, a coupling to put on, and two keys to drive. After the gear is raised up with the falls and worked on, our machinist will start a follower into the keyway and then loaf while the boy runs up and gets a sledge.

There is no need of grinding on this gear; it is just a good drive fit, and goes right home. Our machinist would use sand if he got into the scrape that Tom did, provided he had ever heard of sand being used in such



SIGHT-FEED LUBRICATOR.—*See page* 1.

a case. There is no friction between a shaft and the hub of a pulley. The hole might be full of sand for all the harm it would do. It is not at all like a brake and a brake pulley, and even then the sand which would bed into wrought iron and continue to reduce cast iron to powder would be worth as much as the best Turkey emery. We should like to get hold of an acre of such sand. It would be worth a fortune.

When the boy gets around with a sledge hammer, machinist drives in the spline as far as it goes easy, and then picks up a "backer" or the old-fashioned "key set" and holds it on the spline while Billy strikes on it. Pretty soon the spline begins to go hard, the backer is long and it springs. Machinist begins to be afraid for his fingers. He drops that backer, picks up a short thick one 7" or 8" long, and looks around for the tongs to hold it with. No tongs! Forgot, of course. No matter. Machinist gets a strip of cloth 2' or 3' long and 5" or 6" wide. He winds it two or three times around the backer, puts it in place, and then takes a turn with the cloth around the shaft, the wad of cloth between shaft and backer keeps one end of the backer up just right to be struck with a sledge. There is no jump or "fly-away" to a tool when held in this manner. It takes a little longer, but is a "dead sure thing" every time.

The "left hand thread" business will be explained in due time, and the original bolt shall be presented to the AMERICAN MACHINIST.

An Adjustable Caliper.

The accompanying engraving illustrates a new caliper, which combines the features of the spring caliper and the common friction joint caliper. It can be instantly changed from a small to a large dimension, as with the latter, and then accurately adjusted by the screw, as in the instance of the former. This avoids the barbarous operation of rapping the instrument on a piece of iron, which is necessary to adjust the common friction caliper.

With the latter there is a tendency, when the instrument is *almost* right, to let it pass for *just* right, in the fear that another rap will change it too much. With this instrument the differential screw furnishes a nice, sensitive adjustment, and there is no excuse for inaccuracy. The instrument is neat in appearance, not cumbersome, and can be operated entirely with one hand.

One limb is grooved to receive the other, which makes a good, substantial joint.

The adjusting screw has a thread of 40 per inch on one end, and a thread of 50 per inch on the opposite end; consequently one full revolution advances it a distance equal to the difference in pitch of the threads, or $\frac{5}{1000}$ inch. This motion is multiplied at the points sufficiently to give a desirable adjustment, the whole movement being about $\frac{1}{4}$ inch.

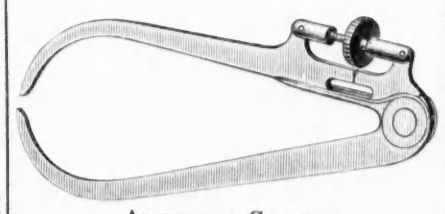
The portion of the limb which forms a spring is always under tension, acting against the screw, and taking up any wear that may take place.

The instrument is made from drop-forged spring steel, and finished in the best manner. It is made in three sizes—4, 5, and 8-inch—by the Ulster Machine Company, Providence, R. I.

A Talk About Steel Castings on Locomotives.

At the recent convention of the Railway Master Mechanics an interesting report on steel castings was presented by one of the regular committees. It was published in our last week's issue. A discussion followed the reading of that report.

Mr. Lauder (Old Colony R. R.) believed that in the near future we should be able to substitute cast steel castings, preferably crucible steel, for many of the parts now made of cast iron, but there are some parts he thought it would be well to investigate before using. He referred to the parts having wearing surfaces. He was of the opinion that steel castings—not cast iron castings with a skin or surface converted into steel—would be difficult to make wear as well as cast iron. He said: "I presume nearly every road in the country has more or less crossheads running that are called cast steel, which is made in Chester. Those castings are not cast steel. If you will plane off from one-eighth to half an inch you will run into the cast iron. I don't mean to condemn them, because they give excellent results, and I think they are preferable to cast steel. A cast steel crosshead will not run in any guide that I ever saw. I have engines with imported cast steel crossheads, and I could not make them run. A man might sit on the front of the engine and pour oil on those crossheads and they would cut. They were running in cast iron guides, by the way, and I was obliged to spread the guides a little and put on cast iron, and then they ran beautifully. You must not attempt to run the cast steel casting without having something on it for a lining or wearing surface, because it will be folly to undertake to run them unless you do this. I have been met in that position by the argument that as cast iron crossheads run in cast steel guides, they could see no reason why they should not run in cast iron guides. I simply say that the first statement is not true; that cast iron crossheads will not run steady in steel guides. They will run, of course, but with an enormous amount of difficulty. So I think running cast steel—if it is steel—on cast steel or wrought iron, or on bronze, will be found a very difficult operation."



ADJUSTABLE CALIPER.

The report advocated using cast steel eccentric sheaves and straps. He had never used them, and thought it would be difficult to do so as the surfaces would cut and they would give trouble in heating and cutting. In early days difficulty was found with wrought iron eccentric straps, then brass was substituted. That made a soft strong material and wore rapidly. After getting to cast iron the difficulties all seemed to be cured, and he doubted the getting of any materal that run as well as cast iron for eccentrics and straps. Being obliged to use something better, and wrought iron forgings being expensive, he hoped all would be forced to use steel, but he recommended the wearing surfaces to be protected by some other material that will give a better wearing surface.

Mr. Johann had gone through precisely the same experience (on the Wabash road) as Mr. Lauder. He had tried to run cast steel crossheads in cast iron guides but was not successful, and finally had to plane them down. He used cast iron linings in place of bronze. After using cast steel rocker arms for some time with apparent success he had to abandon them, as the cast steel rocker wore so much faster that it was annoying. He did not experiment to see *why* it was so, but the fact was plain. Up to this time he believed they have not really perfected their cast steel castings so that we can get very good results from them, but he also believed that the time will come when we can use them, because people will naturally experiment and perfect their castings more than heretofore. "I think," said he, "it is desirable and practicable to use cast steel castings whenever we can get them of proper compostion."

Mr. Lauder said, in order to avoid any misconstruction of his remarks, that he did not wish to be understood as condemning those castings made at Chester. He simply said that they are not in any proper sense cast steel, but he endorsed them fully as a proper material to make crossheads out of. He had run them several years with good results and never broke one. It they were cast steel he did not think they would do as well as they do. Their wearing surfaces act very much as cast iron does.

Mr. Brownell (P. & S. R. R.) had been running both iron and steel eccentrics. The eccentric cuts the strap out. He has two eccentrics, one on each engine, with a cast iron strap and there is a continual cut all the time on the strap.

Mr. Eastman (South Eastern R. R.) never saw such good results with crossheads as he had seen with Chester steel.

Mr. Lauder, in reply to a question, said he would recommend cast steel owing to its increased strength. The material in Chester crossheads is so near cast iron, so much of it is in fact cast iron, that he thought it would give a very much increased strength.

Mr. Eastman, replying to a question, said, the crossheads he used were solid cast steel, and the guides are cast iron without any babbitt or other metals at all. The guides of an engine he had running four years, on which it would be difficult to insert a common piece of lining iron between the slides and the crossheads, are only 3 inches wide. The crosshead is 17 inches long. There are four guide bars.

Mr. Hatswell (Flint & Pere Marquette R. R) had experienced the same trouble in running steel that Mr. Lauder mentioned. He had tried a steel crosshead on an ordinary steel guide with very poor success, and had tried a wrought iron guide with the same result. He had used steel bearings on a crosshead on a steel guide and on an iron guide with no success whatever.

Mr. Lauder thought Mr. H. would find it to be economical to throw away all his case-hardened guides, whether of steel or iron, and substitute plain cast iron. If he never used them he would be astonished how much better they run than a steel or wrought iron case-hardened guide. He would not take as a gift the best set of case-hardened guides that were ever made, if he could get cast iron. Answering a question put by Mr. Finlay, he declared emphatically that he would not have to increase the strength of his cast iron guide over that of the other material. In substituting cast iron guides for steel or wrought iron, provided the wrought iron and steel is a suitable thickness, it is a very much more suitable material.

Mr. McCrum (M. R., Ft. Scott & Gulf Railroad) some years ago tried steel crossheads on steel guides, and could not make them run at all. Then he substituted cast iron gibs with babbitt. He considered cast

iron guides the best he had ever used. Ordinarily he made them a little heavier than steel, but he had some that were not heavier than steel guides. He never had any broken except in accidents. "I think," said he, "if you get good, close-grained cast iron, you will probably obtain better results than with almost any other metal you can use for that purpose."

Mr. Setchel (Ohio & Mississippi Railroad), before deciding to use steel castings in any part of the locomotive, had made inquiry and found that some steel driving boxes had been running six or seven years with the very best results. So, in ordering new engines, he had the driving boxes made of steel that would draw out and make a cold chisel. He found from the start that steel of that kind would not wear against any surface. It would not wear against the hub of a wheel any distance; not if you tied a can of oil right over the top. And he became satisfied that this is the case where there is any liability to side wear. The result was, he had to fix the hubs of their engines, in order to make them run with brass. While he believed that the Chester steel will do good service, he thought the better quality of steel will not run against a bearing surface. In the use of driving boxes, it seemed to him that the only proper method is to use brass of the very best quality, made solid without the insertion of brackets. Twelve or thirteen years ago he built two ten-wheeled engines, and fitted them with solid brass driving boxes and brass wedges. The brass wedges and box together wore fast, but with the substitution of iron for wedges and brass for boxes, he believed that you get the best form of metal and the best kind of a driving box for locomotive service. He had never seen any crossheads on any road made of steel, but in a very short time they had to be encased with brass.

Mr. Whitney (Intercolonial Railroad) said: "Some ten or twelve years ago we had fifteen engines with steel crossheads and steel guide bars, and we always had trouble with them. We had to plane them down and put in brass gibs before they would run satisfactorily. Several years ago we had some new engines built, and the builder thought he would improve on our specification, and give us cast steel crossheads. I happened to be in his shop one day, and I told him not to put them in, and I made him give us cast iron. But with cast steel pistons I must say we have been very successful."

Harrison's Tube Sheet Cutter.

This is a new and inexpensive tool for cutting holes in tube sheets of boilers for the insertion of tubes, or, in fact, for cutting holes in sheet metals for any purpose. Smallest size tool has a range of from 2″ to 5″, that is, will cut holes between and including these sizes.

Fig. 1 shows an elevation of the tool; Fig. 2, a bottom or inverted plan; Fig. 3, a section in a vertical plane indicated by the dotted line, x, x, in Fig. 1; Fig. 4, a section in a vertical plane indicated by dotted line, y, y, in Fig. 2; Fig. 5 shows one of the cutters detached in front view; Fig. 6, side view of same cutter; Fig. 7, end view of cutter; Fig. 8, a detached view of the central reaming bit and guide.

The location and diameter of holes having been decided upon, the center of the holes are marked and punched, or drilled out slightly, a less diameter than the pin P. The nut D is then raised, and the cutters K, K are adjusted radially to the pin P to the required diameter, by means of the slides H, H, and are clamped by the nut D and clamp J, forcing the sides firmly down against the bottom of the slots. The cutters K, K are turned in their sockets so as to present their cutting edges to their work, and then clamped by the set screws M, M, and adjusted vertically by the screws N, N, so that both cutters, K, K, may operate equally. The cutter is then placed in a drill press, and the bit P bores a true opening in the center of each intended flue hole. The sides of the bit P, fitting the hole in the sheet, steadies the bit in the plate of metal, and the cutters cut a channel, or ring, through the metal concentric with the guide. The operation of boring with the central bit P, besides securing a perfectly true and exact fit of the pin P in the plate, also removes all metal that has been overstrained in punching, and thereby buckled. From the form of the cutters K, K, it will be readily seen that any competent mechanic can forge and grind them into shape, and adjustments as to length are readily made by the screws N, N, so that the action of the cutters are equalized.

These tools are manufactured by Remington & Co., Wilmington, Del.

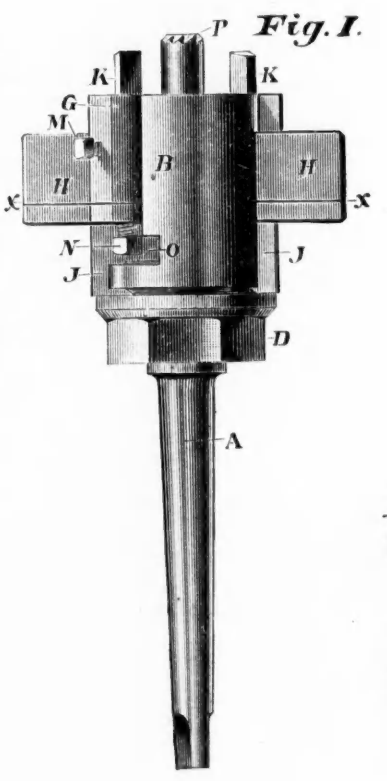


Fig. 1.

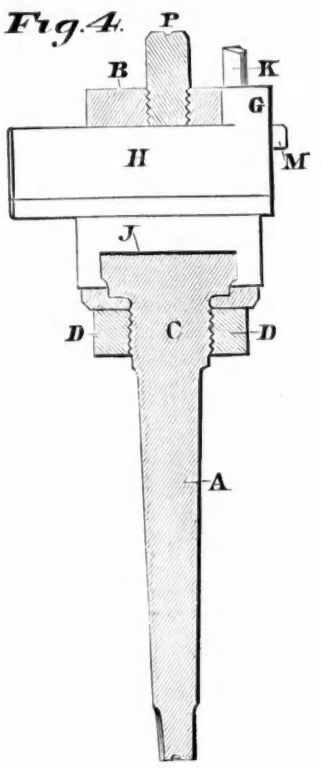


Fig. 4.

Fig. 5

Fig. 6.

Fig. 7.

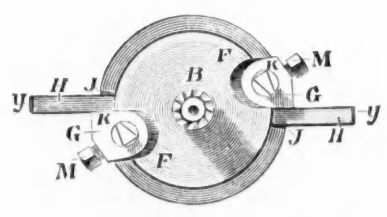


Fig. 2.

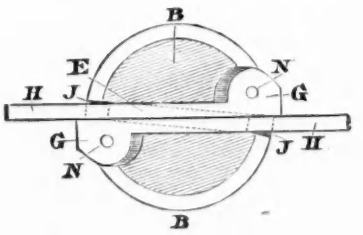


Fig. 3.

HARRISON'S TUBE SHEET CUTTER.

Discussion at the Mechanical Engineers' Meeting.

Replying to the Query Committee's request for data about steam heating, Mr. Towne said:

"Four or five years ago in designing with the late Robert Briggs the heating apparatus for a number of new buildings these questions came up, and they were treated in this way. The system of heating was by exhaust steam and live steam, employed in separate series of pipes carried together throughout the buildings. The design contemplated heating the rooms to a temperature of from 60° to 70° Fahr. in the coldest weather, and it was accepted that 1 square foot of steam surface, one-half live and one-half exhaust steam, in horizontal pipes, could heat 150 cubic feet of space on the average, making judicious allowance for the wall and window exposure and other variable conditions. The general rule adopted, especially for determining sizes of pipes, was, that for each 100 square feet of heating surface in coils or radiators, the cross-sectional area of pipes should be for the exhaust steam .24 sq. in., for the live steam .12, and for the condensed water .06 sq. in., a constant of .25 sq. in. to be added to the total result in each case. The extent of heating surface other than plain tubes was determined as follows: 85 per cent. of vertical surface of any kind, and 80 per cent. of surface having ribs or plates, etc., shall be estimated as equivalent to plain horizontal tubular surface; that is to say, if you have 100 square feet, of vertical tubes you only estimate 85 feet of it as available for heating, and in the other case you only estimate 80 feet as available. In the range of buildings covered by this specification, the overhead system of heating was adopted throughout, and three years' trial of that proved so absolutely satisfactory that, at considerable expense, the old system of overhead heating has been taken out of our other buildings." He thought the overhead system was first applied on a large scale in the cotton and woolen mills of New England 25 years or more ago.

Mr. Walker wished to know if the overhead system of heating by small pipes (say, 1¼″) had proven a success. The Cummer Engine Company, of Cleveland, had tried that system about two years, and had been compelled to abandon it. He knew that large overhead, thin, cast-iron pipes, 4″ to 5″ diameter, were always a success in the cotton mills of England.

Mr. Towne replied that most certainly it was a success. He adopted it in a one-story building, 80 feet in width, 300 feet in length, with a center bay having side sashes its whole length, and with an unusual amount of glass and exposure. It was thought very doubtful, indeed, whether this overhead system would so fill the upper part of the space with heated air as to carry down into the lower part and properly heat it. As it was an experiment that he ventured on with a good deal of diffidence, he made provision in his plans for putting in floor radiators in case the overhead system failed to operate fully, but it had now been in use two winters, and the floor radiators have not been put in and will not be, as the building is well heated without them.

Mr. Woodbury said that mills were successfully heated by five or six rows of 1¼″ wrought iron pipe hung about three feet from the walls of a mill, and two to four feet below the ceiling, the amount of 1¼″ pipe being about one foot in length for ninety cubic feet of space. The experience with this method of heating had been universally successful, even in those portions of mills unprovided with machinery whose operation would induce a forced circulation of the air.

Mr. Partridge said he had noticed, in the buildings referred to by Mr. Towne, that the temperature was very uniform, being about 76° at a height of six feet above the floor and 75° near the floor. He thought the improper arrangement of overhead pipes by crowding in corners might sometimes heat outdoors more than indoors.

A member said, in the machine shops of the Cambria Iron Company, a floor 65 by 34 feet had been heated successfully for two years by the overhead system, while Mr. Durfee knew of a shop in Philadelphia that had been so heated successfully for at least thirteen years.

HOW FAST WILL A STEEL SPRING OPEN AND SHUT?

On the above, submitted by the Query Committee, Mr. Babcock said:

The question admits of two answers—the number of vibrations, and the number of feet per second which a spring can make, and I am not sure which is meant. If the first, it depends upon the size and stiffness, as in the notes of a music box. Some twenty-three years ago I was called upon to design a spring motor for sewing machines, and made a large number of experiments to determine the power of springs. I found this varied greatly with their form and size. The weight which would bend the spring to its elastic limit, was ascertained, which, assuming the elasticity to be uniform, was just twice the force the spring would exert through the distance moved. From this was deduced the number of feet which the spring would lift its own weight. I have no data of those experiments at hand, but from memory should say that this varied from 25 to 150 feet, the lowest being a heavy flat spring, and the highest a coiled clock spring. A watch spring would doubtless give higher results. These figures give an initial velocity of from 40 to 100 feet per second, but as one end of a spring is stationary, and when moving itself only it moves but half its weight, it would lift that half twice as much, or 50 to 300 feet, giving an initial velocity at the center of motion of from 56 to 138 feet, while the free end of a coil or straight spring would move at twice that velocity, or, say 112 to 276 feet per second.

On another query, "Lineal speed at which two gears may be driven, and relation to pitch of teeth and their workmanship?" E. F. C. Davis said: We are using a Mahanoy Plane for hoisting coal, cast-iron gearing, not cut, dry sand castings just out of sand. Wheels are about 15 feet diameter, 18-inch face, 6-inch pitch, and run about 2,700 feet per minute, and sometimes more, doing very severe duty. The two wheels are connected by an ∞ arrangement of 2¼″ wire rope, lifting loads up to 80 tons of coal cars, the 34″×84″ engines transmitting 1,600 to 1,800 indicated horsepower.

Mr. Walker, of Cleveland, said: The fastest running gearing, or rather, gearing making the greatest number of feet per minute, that I have heard of, has recently been made by the Corliss Engine Company. English cotton mills are, as a rule, driven with large gears, and many years ago some good speeds were attained, but nothing to equal what has recently been accomplished by George H. Corliss. Some of Corliss' large gears are now running 3,000 feet per minute. The Corliss Company are now building a large cut spur gear and pinion, about 30 and 10 feet diameter, respectively, 5″ pitch, 30″ face, that will make 4,100 feet per minute. This, I think, will eclipse in feet per minute anything of the kind in the world.

The *Official Gazette* shows no lull in the Patent Office business.

Smoke Stacks and Smoke Arches.

BY FRANK C. SMITH.

The extension smoke arch was originally designed to catch and retain the sparks in the extension. When arranged to do this, it is necessary to clean the arch of sparks from every 25 to 50 miles. This soon became a nuisance to the engineer and fireman, and was complained of to such an extent that a remedy was sought for. Besides, on many long runs the arch would fill up before a stop was made, with the result of throwing sparks badly and a loss of steam.

The frequent filling up of the extension with sparks—the very thing it was designed to do—was remedied by using coarser netting and raising the baffle plate, these adjustments being arranged so that an engine would frequently make 300 miles without the necessity of cleaning the arch. Then about two wheelbarrow loads of sparks were found in the arch, the rest being thrown out of the stack. Now, in a run of 300 miles, what difference would it make to a passenger on the train if the two wheelbarrow loads of sparks had been thrown out of the stack with the rest of them which were thrown out? When it is remembered that if the benefits of the extension are to be utilized it ought to be cleaned at least every 50 miles of two wheelbarrow loads of sparks, or in a run of 300 miles of twelve wheelbarrow loads, the throwing out of the two wheelbarrow loads more or less in that distance would not be perceptible, and they might, therefore, as well be thrown out with the rest as to be run out at the roundhouse ash pit. The question then arises: Of what use is the extension as used on three out of five roads? Practically, as a spark arrester, none at all.

There is, however, an advantage—accidental, probably when the extension originated—which is found in a portion of the smoke arch arrangements and in the extension, and that is a "straight shot" stack, or one without cone or netting, as when properly arranged much larger exhaust nozzles can be used. This leads one to the conviction that the extension of the smoke arch is frequently useless, and might well be done away with—unless it is intended to clean it out every few miles—retaining, however, the straight-shot stack, netting, baffle-plate, etc., in the arch of ordinary length.

It has been widely reported that the extension allows of the use of larger exhaust nozzles, but many master mechanics have found on trying it that this was not the case; others have found that their engines did not steam as well with the extension as with the old diamond stack, and the extension is, therefore, frequently condemned, and the use of larger exhaust nozzles desired.

As much larger nozzles *can* be used and a remarkable economy effected thereby, it is intended in this article to show that the bad results so often complained of are the outcome of bad proportions and malconstruction, rather than any defect in the principle of the straight shot stack.

The action of the steam exhausted from the nozzles into the stack in producing a vacuum in the smoke arch is similar in many respects to the action of a plunger of a pump, the column of ascending exhaust steam acting as a plunger head in the stack barrel, at the same time the friction between the escaping jet of exhaust steam and the gas in the smoke arch act also to carry up and out of the stack these gases. If a person move rapidly about in a roundhouse stall filled with smoke, he will notice as he moves that the smoke for quite a distance on each side of him follows after him, and faster or slower, and at a greater or lesser distance on each side of him as he moves faster or slower. Evidently this action is the result of the smoke and air rushing to fill the space constantly made empty by his movements, as well as by the particles of smoke and air clinging to his clothes by friction, which, by their friction against other particles, etc., drags them after.

If he increase his speed the air, etc., must necessarily follow faster, because the space occupied by his body is vacated or changed faster, and because the entanglement of the particles with his clothes and themselves by friction is greater.

It, therefore, appears that the faster the exhaust travels, the better will be the vacuum behind it in the arch. If we have a barrel of water to empty in a given time with first a one-inch pipe and afterward with a two-inch pipe, it is evident that as the same time is to be occupied the water must travel much faster through the one-inch pipe than the two-inch, because it is smaller. Similarly having a cylinder of steam to empty through exhaust nozzles in a given time, it must travel faster through the smaller nozzle, and it is clear, therefore, why decreasing the nozzles improves the vacuum and steaming qualities of an engine. It appears that the action of the exhaust is first by the friction of the gases in contact with the exhaust steam before it reaches the stack, and afterward as a plunger head in the barrel of the stack, and as the stack acts as an outlet pipe for the nozzles, it is clear from what has been shown that the larger the stack the slower the movement of the exhaust steam through it, and *vice versa*. The quicker, therefore, that the exhaust escapes from the stack the more perfect vacuum will it leave behind it, and it must appear that the *size* of the stack has an influence on the steaming of an engine well worth considering, and especially so when it is a straight shot stack.

Colburn, in his work on the locomotive, on this point, concludes, from a mathematical investigation, that "the vacuum will increase with the speed and density of the steam, and it will be diminished by a proportionally wide escape pipe or chimney." And again: "The vacuum decreases, though not in a direct proportion, with an increase of area of the chimney," etc. And regarding the quantity of air drawn by the exhaust, he says: "The quantity of air decreases with an increase of chimney area."

Master mechanics have paid comparatively little attention to the stack as a vacuum producer, many going on the principle that, as a big stack is the thing for a stationary boiler, it will act as kindly for the locomotive, without considering the facts that the action of the one is due to natural causes and the other to artificial and mechanical means. The popular practice has been to give the stack barrel the same diameter as the cylinder, and with the diamond stack it really makes very little difference whether the stack barrel be an inch or two larger or smaller than this rule determines. If a shingle be held across a stream of water thrown from a hose and nozzle, the result is to cause the stream to spread out sidewise, and increase its diameter at that point, as any one can easily determine. In a diamond stack, the cone acts similarly to the shingle, causing the steam and smoke to "upset," as it were, and back up on itself, thus driving it out sidewise and forcing it to fill the barrel of the stack, as shown in Fig. 1.

With the straight-shot stack and high nozzles with a comparatively parallel passage, the exhaust steam shoots directly up and out of the stack, with nothing to spread out against the stack, and it therefore, with a large stack, fails to make a tight joint against the stack barrel, as shown in Fig. 2, and acts like a piston with the packing "down," with the result in extreme cases, probably, of the atmosphere entering at the top of the stack, as shown by the arrow.

The extension is frequently condemned because the same size of stack as the diamond stack is used on it, in place of a smaller one. As an incidence of this in my own knowledge, one road fitted several of their engines with the extension. These engines were 16″ and 17″, and had steamed equally well with 16″, 17″ and 18″ diamond stack, no special size of stack being used on this road. A 16″ engine on this road steamed badly after the extension was applied, having a 16″ straight shot stack, with $2\frac{1}{2}$″ double exhaust nozzle. In conversation with one of the officials relating to this engine, I suggested the insertion of an inside pipe, *a*, Fig. 3, tapering from 16″ at the base to 12″ at the top opening. It was tried, and the engine steamed better than ever before, and with $2\frac{7}{8}$″ nozzles.

Howard Smith, general master mechanic of the St. Louis Bridge and Tunnel, has found that his engines steam much better by using a base casting with a smaller throat, as shown in Fig. 4. These devices improve greatly an existing stack, where the expense of changing to the correct shape cannot be incurred.

A test to determine the most advantageous diameter of stack on a 19″ × 26″ Mogul showed that, as the stack was decreased in diameter, the nozzles could be increased, until the maximum point of efficiency was reached with a $14\frac{1}{2}$″ stack, the nozzles having been enlarged $\frac{3}{8}$ of an inch in diameter from the size required with an 18″ stack, with which the engine was originally fitted.

Experiments have shown that the amount of air under pressure which could escape through a cylindrical pipe with square corners, as *A*, Fig. 5, was represented by from 75 to 80, while from a correct-shaped pipe of same diameter, as *B*, Fig. 5, the amount was represented by from 95 to 99. In view of this, it appears odd to find so many stacks starting off squarely from the arch.

For a straight-shot stack the best approximate area has been found by experiment to be the area of the cylinder divided by 1.6, and the shape to be as shown in Fig. 6, when the smallest part, as 1, should be of the area as found above, the other sizes being based on the diameter at 1; that is, the opening at the top to be $1\frac{1}{4}$ times the diameter at 1, etc.

D. K. Clark, in his Railway Machinery, says the best shape for the top of the stack is square, and without any finish, as shown at *A*, Fig. 7, the bluff, square shape causing the air to shoot up and over, in place of passing directly across the top of stack, as the finish, as at *B*, allows of. This may be easily demonstrated if a person will stand on top of a high building or bridge with a square edge, as at *A*, in Fig. 8, in a high wind. He will find he is in a comparative calm.

Although the single nozzle appears to be

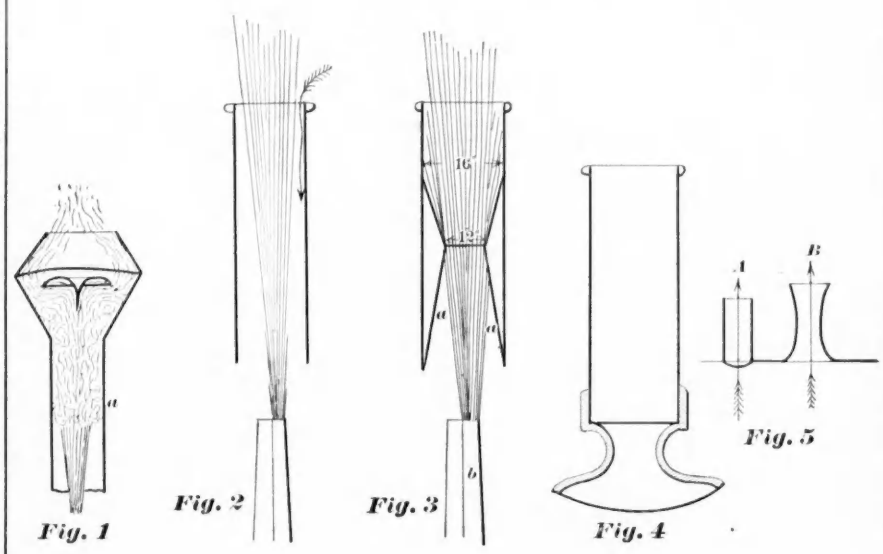


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

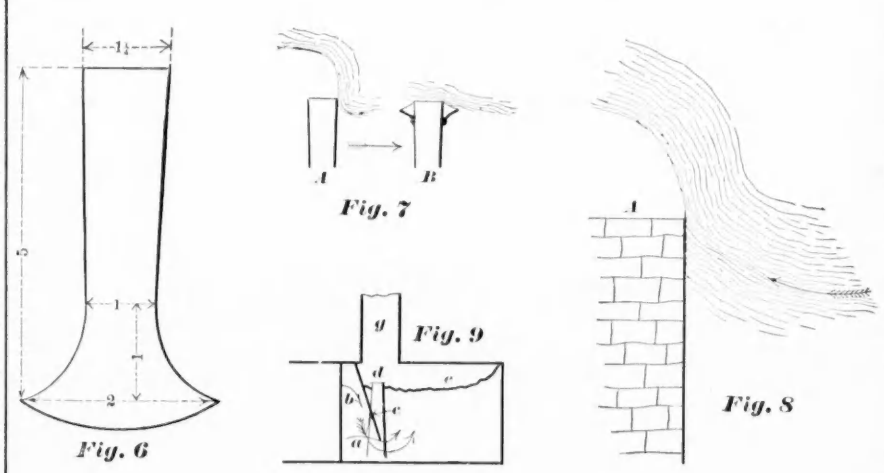


Fig. 6 Fig. 7 Fig. 8 Fig. 9

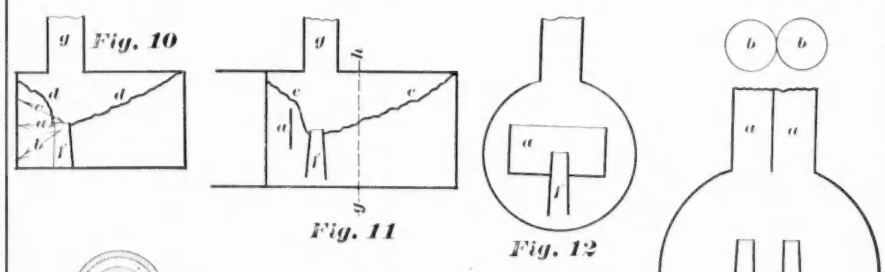


Fig. 10 Fig. 11 Fig. 12 Fig. 13

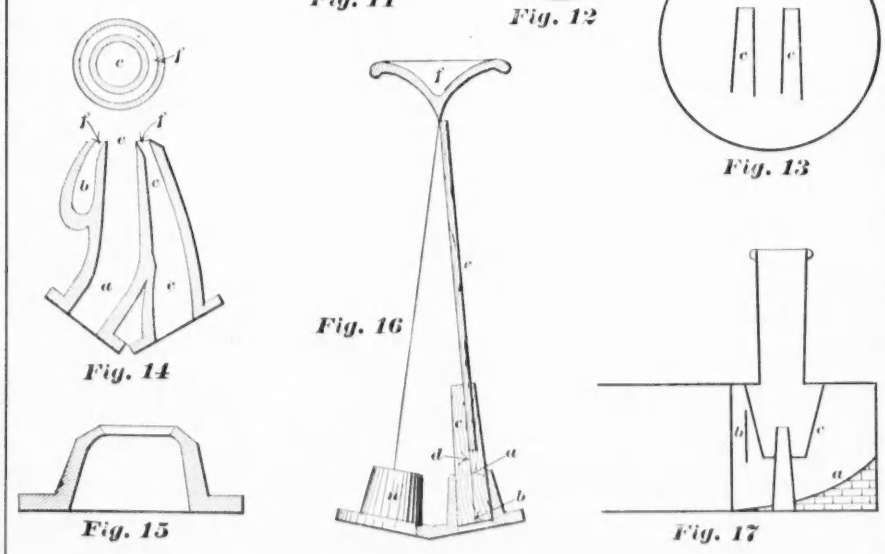


Fig. 14 Fig. 15 Fig. 16 Fig. 17

used almost exclusively in Europe, it does not find much favor in this country, as it appears, no matter how high up the partition is carried, a certain portion of exhaust steam will shoot over into the other cylinder, creating back pressure, which is especially noticeable as the engine is worked heavy. Unquestionably, the shooting of the exhaust centrally up the stack should give better results than shooting it to one side of the center, as is the case with double nozzles. To remedy this and still use the double nozzle, I once saw tried a double stack; that is, one for each nozzle, as in Fig. 13, in which *c c* are the nozzles and *a a* the stacks, *b b* being a top view. This was, of course, a failure, as, while the exhaust from one cylinder was passing out of the stack, the air entered the arch through the other.

A much better arrangement is shown in Fig. 14, to which I know of no objection. The exhaust from one cylinder passes out of *a c*, the other up through *c c*, and out of the annular opening *f f*, *b* being a belt cast around the nozzle *a*, and in communication with *c c*.

The shape shown in Fig. 15 for the tip or nozzle appears to be the best, as it tends to prevent the spraying of the exhaust steam.

Fig. 10 shows an extension without the baffle-plate, *d d* being the netting, *f* the nozzle, and *g* the stack. It is evident that the center flues would have the strongest draft in this case, as the distance *a* is shorter than *d* or *b*, the distance to the top and bottom flues. To equalize this. the baffle-plate *c*, Fig. 9, was introduced; but it frequently occurs with this arrangement that the top flues are so much uninfluenced by the exhaust, while the bottom ones are excessively affected as to be set to leaking. A better arrangement to bring all the flues into action is shown in Figs. 11 and 12, in which *a* is the baffle-plate, *e* netting, etc. This plate being capable of extension by sliding up and down as well as lengthwise, it is an easy matter to adjust its dimensions so that all flues will feel equally the effects of the exhaust. Unless it is intended to clean the extension every thirty miles, the extension forward of the line *g h*, Fig. 11, is useless, the arch being left as shown up to the line *g h*. No trouble will be found in this short or ordinary arch filling up with sparks if the exhaust nozzles are not higher than the center of the flues, and it is generally found that low exhaust nozzles can be worked longer than high ones.

A splendid smoke arch arrangement is shown in Fig. 17, especially when the brick arch in the fire-box is used, the sparks thrown appearing to be much less than the ordinary diamond stack throws. In this *c* is a cone of netting, *b* baffle-plate, and *a* bricks giving the bottom of the arch an upward curve, which in many cases proves of great benefit and is well worth trying.

Many authorities make the area of the stack a stated fraction of the grate area, which appears wrong, because the combination of the stack and nozzles forms a vacuum producing machine, and for the best results these must bear a given relation to each other. As the nozzles are largely dependent as to size on the size of cylinder and the diameter of stack on the nozzles, it makes the best approximation in practice to make the diameter of the stack form some proportion to the cylinder, and especially so as grate area is constantly increasing.

A great many engines are prevented from steaming, on account of the exhaust nozzles having the wrong angle, shooting to one side of the stack. Fig. 16 represents a plan used by the writer to ascertain if the nozzles have the correct angle.

The nozzles are taken down and a piece of wood, *c*, fitted, as shown. The center of the lower and upper openings are found and marked as at *b a*. The line *d* is drawn through these points. The nozzles are mounted in place, and a straight edge *e* placed fair with the line *d*, which will show where the nozzle is lined to.

The total depth of a bore-hole on a German railroad is 4,559 feet. The diameter at the top is 11 inches and at the bottom $1\frac{7}{8}$ inch.

New Self-Lubricating Loose Pulley.

The engravings, Figs. 1, 2, 3, and 4, represent a pulley of this class, the invention of George H. Smith, Providence, R. I., made by the Brown & Sharpe Manufacturing Company, of that city. In these engravings, Fig. 1 is a side elevation of pulley; Fig. 2 a section on dotted line of Fig. 1; Fig. 3 section on dotted line of Fig. 2, showing the condition of lubricant at time of starting; Fig. 4 shows the condition of lubricant immediately after stopping.

The pulley is placed in the position represented in Figs. 1 and 4, and the lubricant is supplied through the plug shown in Fig. 1, filling the cavity up to the bottom of the opening for filling.

Upon starting, as the pulley runs the oil will be forced, centrifugally, outward, and will circulate over the ends of the partitions shown. When stopped, a portion of the lubricant will settle in the lower part of the chamber, and a portion between the uppermost partitions, and find its way to the bearing of the pulley through the small space left between the two parts of the hub, thus lubricating the surfaces sufficiently for the next running period. After the pulley has remained at rest for some time, all superfluous oil will have settled to the lower part of the chamber, the bearing surfaces retaining sufficient for lubrication; this will occur without waste of oil, as will be readily understood from the construction.

Altogether, this pulley appears to be of excellent design, and one that will, in operation, be very economical in the use of oil, and correspondingly clean.

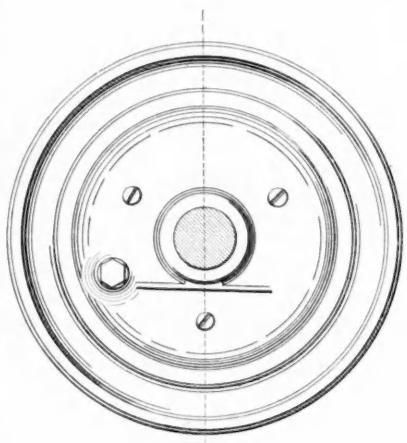


Fig. 1

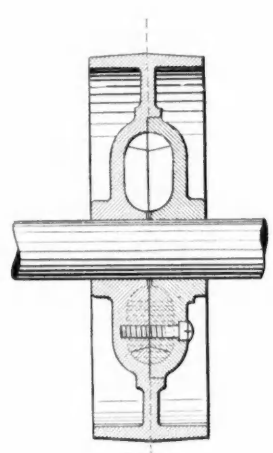


Fig. 2

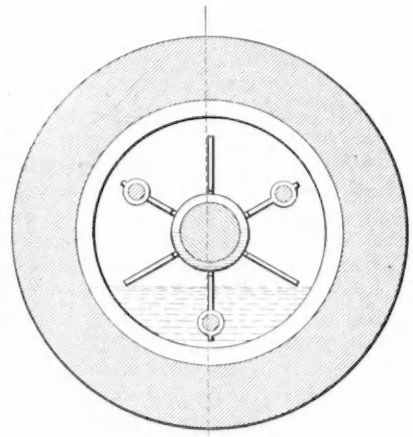


Fig. 3

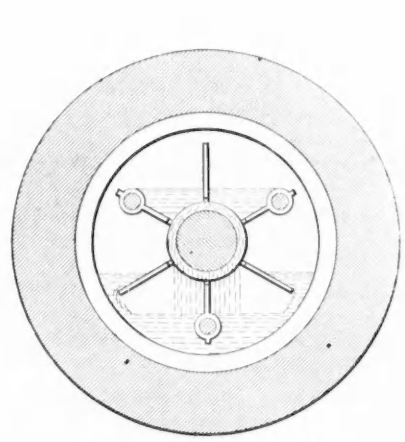


Fig. 4

The Fuel Question.

BY F. G. WOODWARD.

I recently saw somewhere in print a prediction to the effect that at the present rate of depletion, the coal beds of this planet will be exhausted in less than 400 years. The present annual rate of coal consumption may probably be pretty accurately known, and if by any process the number of tons yet stored in the earth could be determined, the problem might be easily figured out. But he must be something more than a prophet, or the son of a prophet, who can tell us this, hence we may conclude that this, and all like predictions, are mere guesswork. And we think that it would better accord with present knowledge of the earth, and man's doings upon it, to put the guess at four thousand instead of four hundred years, Yet, when such predictions bear the impress of sincerity, they naturally set one of a reflective turn to thinking concerning these incessant activities, those far-reaching processes which are slowly yet surely changing the physical condition of things.

In order to comprehend approximately in due proportion the significance of some of these changes, let us, with the help of a little imagination and a few figures, construct a model earth. Let the reader picture in his mind's-eye a globe twenty feet in diameter; this will represent the earth on a scale of one thirty-second of an inch to the mile. Now, the human family is computed at 1,200,000,000. Allowing three square feet of standing room for each person, the entire race, on a like scale, would cover less than three-eighths of an inch square on this model globe; or, to put it otherwise, a piece of tissue-paper of like area would measure the entire bulk of this assembly in length, breadth and stature. Now, divide this bit of tissue-paper into 100 equal parts, and let one of the parts represent the whole mining fraternity of the world. This proportion would probably far exceed the fact, yet it would hardly be visible to the naked eye on the scale of our model. A bit of thread five-sixteenths of an inch long would represent a mine ten miles in extent and one mile deep, hence a few pin scratches and punctures from one-sixteenth to one-fourth of an inch long and one thirty-second of an inch deep, would represent about the extent of man's mining operations for the past 6,000 years or so.

The Hoosac tunnel may be represented by a bit of microscopic fiber five thirty-seconds of an inch long. The reader may extend the simile at pleasure, and thus gain some just appreciation of man's work, and its results upon the globe. Surely if mankind, through the toil and vicissitudes of the thousands of years that have passed, makes so insignificant a showing, what may be expected 4,000 years hence? Probably the beds of coal will have then somewhat diminished, but what of the vast stores of fuel that have been accumulating for ages, and will continue to accumulate for ages to come, at the equator from ever-decaying vegetation? The area of land thus stored with fuel may be represented upon our model by a section fifteen inches by twenty-four feet. Compare this area with that we have just assigned to humanity, and we must conclude that there will be a mine of fuel large enough for all hands to work in when the coal gives out.

LETTERS FROM PRACTICAL MEN.

Casting Rolls on Wrought Iron—New Iron Versus Scrap.

Editor American Machinist:

In the matter of casting rolls on wrought-iron shafts, perhaps few subjects of more importance could be started as regards foundry interests, and machinists as well.

For thirty years, boy and man as a moulder, I have had chances of being able to judge of the value of such attempts. That wrought-iron shafts can be placed in moulds and satisfactory results obtained, is certain. These results can only be obtained, however, suitable for certain purposes, and under certain conditions.

Let me preface what follows, by giving one example from many. Years ago, I worked at the South Boston Iron Company's, and undertook, after a lengthy consultation with the foreman, to make a breaking weight (about 2,000 lbs.) which should surprise, in time, the foundry faculty the world over.

The company bought large amounts of the larger old machinery for air furnaces, and cupola, so that the breaking weight being almost constantly in use, had to be renewed frequently; but we would make a weight that would not want renewing.

We did. I made the mould. We then wired together wrought-iron rods and distributed them through the mould. In casting (old scrap, etc.), I took my position to look down the riser (on top). I don't suppose the hubble-bubble of the cauldron of Macbeth's witches was a circumstance to the commotion going on.

Well, the "child was born," carried to position, elevated twenty-two feet in the air once—only once—and fell a shattered broken mass. The foreman came in the shop and told me the weight was a failure.

I asked if it was really a fact that we had been setting an elephant trap to catch a mouse. "We haven't caught the mouse," he replied, "the old casting broke the weight all to pieces."

The point I desire to present here is, for want of the knowledge of the experiences of our fellows, "The best-laid schemes of mice and men gang aft aglee."

A roll five feet long, and five inches diameter, with a shaft in it three inches diameter, was ordered in green sand, cast flat. Day after day, was this roll cast, result, failure, and to this day, it was never made, at any rate in that foundry. It was tried in every (at that time) conceivable way, chalked, oiled, cold, with risers in and without.

At about the end of two weeks, we had the shaft made red-hot, ladles of iron ready, red shaft put in mould, quickly closed and fastened, and metal poured. Had six flow gates on top. That mould boiled and purged until it thickened beyond further action.

Subsequent experiment has since proven to me that the commotions in the two instances referred to above were caused by the evolving of gas or gases from the cast iron employed. I am quite clear, a large proportion of the old scrap bought in the market, and especially burnt iron, such as old grate bars, cannot be made to lay in harmony with wrought iron. Such was the stock largely used in the above instances.

"Why?" you ask. I answer, "I do not know."

It belongs to the analytical chemist to examine and define that (at present) mystery. It is either the presence or lack of a certain gas in the cast iron that prevents harmony between the two metals.

Proof—any foundryman can try, by making open sand mould (any shape) place in your wrought iron. Now make sure you cast with a good quality of new iron. Then cast another with what you know to be old scrap, and if possible, some burnt grate bars, and my word for it, you will want no further demonstration in that direction.

Take a piece of iron or steel rod, near the

center, attach a string, now holding by the string, strike with another rod or small hammer. The rod you hold will presently become polarized, one end North, the other South pole. What makes it?

I don't know. I do know, that some disintegration of its parts has taken place; I do know that the jarring, vibratory action to which all machinery is more or less subjected to, is steadily causing a chemical and mechanical structural change in cast iron—doubtless in all metals.

Quite a number of years ago, a captain of the United States Army set a soldier to work with a hand hammer, to break the trunnion off a condemned ten-inch cannon; such a trunnion is ten inches diameter. One soldier being relieved by another, at the expiration of some fifty-two hours, the trunnion fell off.

The question arose, which blow broke the trunnion?

Not this one, or that, the first, or last. Every blow broke the metal—disintegrated it.

The popular notion that exists with foundrymen—that scrap mixed freely with "pig," makes better, stronger iron—has no foundation at all, in fact. Until it has lain in the earth sufficiently long, charged by electric currents, enabling it to regain its magnetic, or what may be termed its true chemical structure, it is absurd to talk of it being as "good as new iron" (ordinary).

TAPPING BAR.

Speed of Small Steam Yachts.

Editor American Machinist:

I would say to your inquiry regarding speed of small steam yachts, that in the winter of 1877-'78, I designed and built a launch 19′ 11″ over all, 52″ beam, 30″ draft, a false keel coming down to protect the screw. Engine inverted cylinder, 4½″ diameter, 4″ stroke; balanced valve cutting off from ⅛″ to 2″; screw, 20″ diameter, 40″ pitch, 2 blades. The boiler was upright, a compromise between a shell and a coil, with grate 20″ diameter. Steam pressure allowed, 225 pounds. With this launch I ran a measured mile in 5 minutes and 6 seconds. Owing to pressure and superheating of steam, I was troubled about lubrication, and the cylinder was badly scored. I forced a bushing into cylinder, reducing it to 4″ diameter, and made valve and rings of three parts copper and one part tin, and ran without oil. I then made a run of 9½ miles against a slight current in 47½ minutes, or at a rate of slightly in excess of 12 miles per hour. This was a forced run, but 9 to 10 miles per hour were easily made. COG.

Side Rake of Thread Tools.

Editor American Machinist:

In your issue of May 30, under the heading "Chasing Threads," Mr. Bartlett says: "Any man that calls himself a tool maker, and don't give thread tools side rake, better go and learn a trade." If I understand correctly the meaning of rake of a tool, it implies the form of that portion of the tool which presents a surface to the advancing metal; that portion against which the chip impinges, and which, if it has rake, presents a surface at an angle other than a right angle, and the clearance, that portion below or behind the part being cut. Believing the definition correct, I will be as plain for a few words as was Mr. Bartlett. That is, if any man grinds his thread tool with side rake or any other form of rake for plain screw cutting he needs to go and learn a trade, and that the machinist's trade.

I believe the accompanying sketches will in a measure explain my view of the matter. In Fig. 1 *B* is a section through *M N*, *A A* parallel sides of two consecutive threads, showing pitch or angle of same, dotted line *C* extreme cutting point of tool. I hold that in a tool properly made *C* should be parallel to *A A*. *H*, which is the top or surface presented to the advancing metal, should be at a right angle to *C* and *A A*, for the obvious reason that in the case of a V thread both sides of the tool should cut, and each side should offer the same resistance to the metal; then the result will be cuttings from both sides of uniform thickness represented by curved lines at *c*, *c′*. If side rake be given as claimed by Mr. Bartlett, shown at *c*, *x*, the cutting quality of *c* will be improved, while that of *x* will be correspondingly injured.

I think it will be clear to all, that while everything at *c* is going on swimmingly, the business that is being done down in the corner at *x* would astonish the mechanical intellect of a native, if he were to behold it under the revealing power of a microscope. The torn and mangled (not cut) fragments of metal are being jammed down into that corner, more metal being torn off from the rapidly advancing screw and jammed down on top of the first; not much chance for escape, till finally the tool cries out from unequal exhaustion, "I can't stand this; I am all worn out and tired at *x* and am compelled to crowd over toward *c*, which for some reason or other (owing to its shape, I presume) seems inclined to draw off on its own hook." Certainly *x* crowds hard, *c* rejoices and goes in for a larger mouthful, man at the lathe sees large chip, thinks he is doing a heap of work, runs a few cuts over, happens to think he had better try his scale on the work and see whether he has got the right pitch anyway, lays on 12″ scale, discovers—what? He has got a patent increase

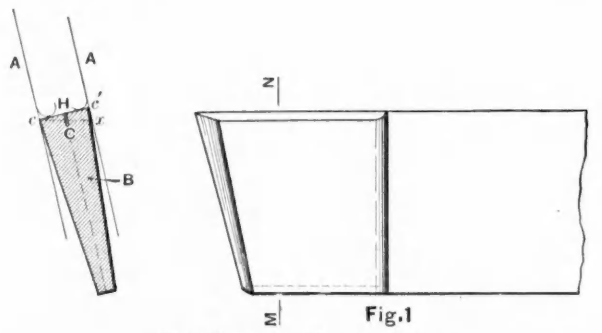


Fig. 1

SIDE RAKE OF THREAD TOOLS.

twist on his screw, the result of the kicking in the corner at *x* and the greed of *c*.

I think this is enough, and perhaps far too much of the ridiculous, in explanation of the style of thread tool I would recommend for use.

D. M. HURLBURT, Tool Maker,
N. Y. L. E., W. R. R. Co.
Hornellsville, N. Y.

An Industrial School in Atlanta.

Editor American Machinist:

You will, no doubt, be pleased to hear of our efforts to start an industrial school in this city, and of our complete success. Last January a few gentlemen, at the request of Dr. G. L. Chaney and Mr. Elias Haiman, met together and proposed to open a night school for the benefit of the working lads in this city. It was decided that the school be opened in February and continued until the end of April, three months as an experiment, and if successful to reopen again next October. Mr. S. M. Inman, Mr. W. C. Morril and other gentlemen subscribed $1,000, and I offered my services to take charge of the school with Mr. F. Ledule and Mr. Wm. F. Ott as assistants.

We bought a lathe, drill press, vices, carpenters' and pattern maker's tools, drawing instruments, smiths' forge and other tools. We hired a room with steam power and light and started work in February. Our school nights were Monday, Wednesday and Friday in each week. We had room for 20 boys, but so many applying, we increased the number to 25. Monday and Wednesday nights we had general work, and on Friday nights, we rigged up some skeleton desks on the work benches, and gave instruction in drawing and geometry.

Most of our lads were apprentices in shops, railroad and private; some had been in the trade three and four years, and some as many months, consequently we had to find out what a boy could do, and gauge the work to suit. We had one on a valve seat (I had an old steam pump sent up to practice on); we had three of our best lads on surface plates, some filing and chipping; one on the drill; another on the lathe; one or two at the forge, and some on patterns and core boxes. The boys stuck to work in splendid style, and I would like you to see some of the nice little jobs they turned out.

It is almost impossible to find a first-class American vise hand, one that can use a hammer and chisel and file properly. They can all run a lathe, planer and milling machine, but put them on the vise and they get left, therefore we made vise work take the first place. We gave a boy a cast iron cube about 1½″; he had to take a hammer and chisel and take a light chip off each side, making the cube as perfect as he could. No "choking" hammers was allowed. We then gave him a 12″ flat bastard file, and taught him how to hold it, and also to file properly. No forefinger on top of the handle was allowed, neither was the point of the file used to take out the round place in the center of each face on the cube. It made me tired to see how some of the lads 20 years old, who had been at the trade 3 or 4 years (in a good shop, too) picked up a file, hand on top of the handle, and watch them seesaw up and down with elbows about a foot away from their bodies. They thought they could file too, but they don't think so any more. Anyhow, we taught them all we could in the time allotted until the end of April, and I can assure you the lads thoroughly appreciated our earnest endeavors.

The noble-hearted gentlemen that gave the money desired to run the school another month. We did so, and finished up last week. When we had the school thoroughly on its way, we invited the leading men in this city to come out and see us. Several of them came, amongst whom was Mr. Henry Grady, of the *Constitution*, who will, through his paper, make a great effort to increase our facilities next fall, so that we can accommodate 100 boys. There is no doubt that our little attempt will result in a first class technical and industrial school in this city. When the people of Atlanta make up their minds to have anything, they are going to get it, and in good style too, and with the help of Mr. Inman, our best citizen, we can lead the South in this kind of work. If any gentleman on your paper is down this way, we should be delighted to see him, and can promise him a good welcome, for the AMERICAN MACHINIST is a standard publication in Atlanta.

H. T. ROFFE,
Supt. Georgia Machinery Co., Atlanta Ga.

Casting Rolls—Different Kinds of Steel.

Editor American Machinist:

"D. C. B." wants to know how I cast the roll referred to in the May 3d issue of your paper. The mould was made in green sand, and cast horizontally. The shaft was put in cold, but it was turned all over. As regards the two hundred of hot iron heating the shaft, I do not suppose for a moment that it made the shaft red hot all through, but it made it hot enough, so that the cast-iron adhered to the wrought. As I stated in my first letter, the cast part had to be turned all over, and the casting came out solid. The rolls are used in our shop, and speak for themselves.

As to making the shaft red hot before putting it in the mould, as Mr. Hetherington referred to in his letter, it is a very good plan, but the mould will have to be made of dry sand, or it soon will be one after the shaft is put in, if made of green sand. I consider the tinning the best way, as I have tried all the others and do not find them as good.

As steel is the great question at the present time, perhaps a few notes on making steel would not be out of place. Blister steel is made by causing the carbon of charcoal to penetrate iron in a heated state; German steel is blister steel rolled into bars; shear steel is made by hammering blister steel; double shear steel is made by cutting up blister steel and putting it together and hammering again; crucible steel is made by melting in a pot blister steel and wrought iron, or unwrought iron and charcoal scraps; Bessemer steel is made by blowing air through cast-iron; open-hearth steel is made by melting pig iron, and mixing wrought iron or scrap steel to reduce the silicon and carbon.

I enclose you a sample of open hearth steel that I made myself in our shop.

Galesburg, Ill. DAVID SPENCE.

[The sample referred to appears to be o very good quality.]

Countershaft Brake.

Editor American Machinist:

I have of late been shown a dozen labor-saving tools gotten out by Mr. Hiram Jones, foreman of the D. and R. G. Railway machine shops here, who, for the cramped room, poor opportunities, few men and fewer machine tools he has to contend with, has more labor-saving rigs than most railway foremen. He has, to me, at least, a new scheme to stop planers, shapers, drills, etc., quickly and where you want them. He clamps a piece of hard wood on to the belt-shifter rod, so that when the belt is shifted to loose pulley the block will rub the edge of the tight one. The belt can be shifted to use or not use the brake at the will of the operator. It is very nice to prevent tools on shapers stopping over work, and saves time on many fast-moving machines. Mr. Jones is a close student of the AMERICAN MACHINIST, and if he had less modesty, or I had his ability, or he had my gall, your readers would get good descriptions of all his kinks.

So. Pueblo, Col. J. A. HILL.

Forming a Draftsmen's Society.

Editor American Machinist:

In my article in regard to forming a society of draftsmen, I did not mean to say that it should be the same in details as the A. S. M. E. or the Order of Progressive Machinists. I meant that there is almost no limit to the benefits that may be derived through an "interchange of knowledge on any subject. I have found one great obstacle in forming the O. P. M. It is the *jealousy* among mechanics. They all have their little secret ways of doing work, that they don't care to have any one else have the benefit of. This is all false pride. A man who thinks he knows it all, will sooner or later find that he does not know much of anything.

If the O. P. M. can assist Mr. Butler in any way in regard to his proposal, it will do so with pleasure.

K. ALEXANDER,
Chief Master Machinist O. P. M.

Steam and Air Pressure.

Editor American Machinist:

In your issue of May 23 Mr. Beatty asks if a locomotive with 40 pounds of air can release brakes applied with 90 pounds of air. I have not tried it on trains. I can give him my observations while testing my work. My testing apparatus consists of a complete engine and car equipment, with connections for attaching air drums, regulators, train signals and triple-valves to be tested. I apply the brake with a pressure of 60 pounds, discharge the air from main reservoir, and in pumping up, the brake released with 35 pounds of steam; applied with 90 pounds and released with 42 pounds; changed triple-valves with the same results.

A six-inch air pump will compress air to a greater pressure than the steam pressure that drives it, provided it is in good order and the connections tight. Our boiler blows off at 80 pounds. I have had pumps record 115 pounds of air. It is a very common affair to have them record from 10 to 20 pounds more air than steam pressure on the boiler, the steam gauge on the boiler and one on the

pipe supplying the pump tally, and are frequently tested. R. N. MARTIN.
Renovo, Pa.

A Boiler Makers' Club That Promises Well.

Editor American Machinist:

Your editorial on mechanics' societies is a suggestion of utility, and if taken advantage of would be the means of doing more towards elevating the mechanics of the day than any other means that could be employed. Being a boiler maker, I have found it very difficult to obtain information upon subjects which I deemed essential, and referring to our daily avocation; and often have made inquiries of men whose business demanded all their attention, but who very willingly imparted the desired information.

Having to work amid the noise and confusion of a boiler shop, it is useless to seek oral information, even should the question asked be very brief. It occurred to me, however, that something could be done to gain knowledge about science and its principles, and to promote more interest in our work; and with that object in view I introduced the subject of a mechanics' school or club to as many as would be willing to devote some of their spare time, but found it useless, up-hill work. However, not being daunted, three of us in this city formed the nucleus of one, and in order to try and stimulate some of our fellow craftsmen in other cities, I will cite some of our routine of work.

Having concluded to use our homes as places of meeting, and selected the evenings, also subjects for discussion and drawing, we purchased the necessary materials—mechanical books, drawings, tools, and paper—and made a beginning. The first subject was an elbow in four sections. The drawing was finished and a template made of paper; but we wanted to see if our diameter, holes, etc., were correct. This we found very inconvenient. It was suggested to make a pair of wooden rollers, and make our templates of tin and light sheet iron. The rollers were made, and consisted of three oak rollers, 24 inches long by 3½ diameter, set in an oak frame 2 inches thick and 9 inches wide, with two short pieces of staybolts for set screws.

Every week one suggests a template. It is drawn, and template made of tin or sheet iron, and it is put together. Thus we are able to see if holes coincide, and if object is as desired or contemplated. We also exchange ideas and opinions, which could not be done if we acted individually.

I hope your suggestions will be acted upon, and to hear of clubs, as you speak of, in many cities. S. C.

New File Holder.

This holder is the invention of W. H. Phelps, and is manufactured by Kearney & Foot Company, 101 Chambers Street, New York.

In the engraving, *A* shows the top of an adjustable clamp, operated by the threaded bolt. By running the nut on or off the bolt, adjustment is quickly made for any width of file, and with the small wrench shown the nut may be tightened, bringing clamps *A*, *B* and *C* firmly against the edge of the file.

D shows in end section a hard-wood block 6x2½ inches, ⅞ inch thick. By covering this with emery cloth or sand paper and attaching the holder, an excellent arrangement for using emery cloth or sand paper is provided. Any other desired form of blocks can be readily made.

This holder is simply made, and should last for years. Its construction is such that it will hold the file conveniently for filing large flat surfaces, the bottom and sides of long grooves, etc. Machinists, pattern makers, and other mechanics will understand its uses without enumeration.

Mr. Morrison, of Illinois, announces that he is drawing up another tariff bill. It will have lateral, curvilinear, diagonal and perpendicular as well as horizontal features.—*New York World.*

Hydraulic Tests of Locomotive Boilers.

The committee on this subject, consisting of H. N. Sprague, of the Porter Locomotive Works, W. L. Hoffecker, O. & M. Railroad, and D. O. Shaver, Pennsylvania Railroad, reported at the Master Mechanics' Convention that they had issued a circular to the members asking replies to the following questions:

1. Is the frequent testing of boilers by hydraulic pressure desirable? If so, how often should these tests be made? What excess over working pressure should be applied, and why?
2. Do you recommend other tests in connection with hydraulic? If so, what other tests, and why?
3. Do you consider the test of a locomotive boiler at rest by hydraulic pressure conclusive to its safety under all conditions of service?
4 Please give any information you may have on this subject, not called for in the foregoing questions.

The committee said, in substance, that they had received replies from 13 members out of 250, three of whom were entirely opposed to hydraulic tests, one thinking they were an injury to the boiler, and another saying that he had seen a boiler leak at every joint under hydraulic pressure of 120 lbs., which was perfectly tight under equal steam pressure.

Of the ten members who favor hydraulic tests, all give decided preference to hot over cold water as giving proper expansion to the parts, and favor the introduction of hot water in preference to firing the boiler filled with cold water, as the want of circulation by the latter plan is likely to produce unequal expansion. While some favor frequent tests, and others think them only necessary after general repairs to boilers, they all recommend careful inspection to detect pitting and grooving, and hammer tests to detect defective stays and braces. The excess of tests over working pressure recommended by different members varies from 25 to 40 pounds, and while they do not consider the test at rest conclusive as to perfect safety under all conditions of service, yet it is as conclusive as any test under such condition.

Mr. Lawson (Lawson Non-Explosive Boiler Co.) thought hydraulic tests desirable, with sufficient pressure to discover leaks. He thought a pressure not exceeding one-fifth of the tensile strength of the material could do no harm.

Mr. Johann, (W. St. L. & P.) was decidedly opposed to excessive cold hydraulic tests. He considered it liable to create a defect where none previously existed, and favored the hot hydraulic pressure applied with the Rue apparatus, connected to a system of steam pipes running to the pits.

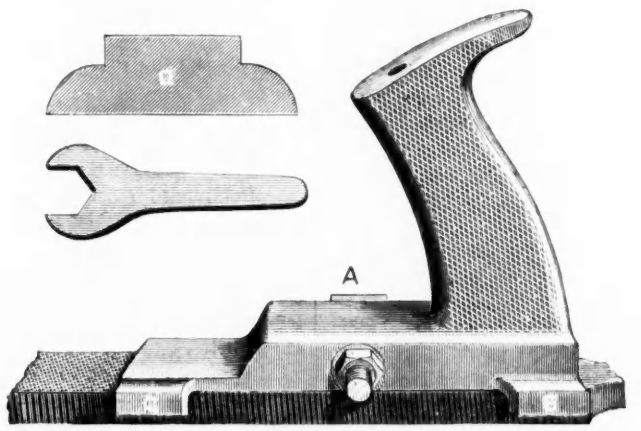
Mr. Barnett (Grand Trunk) favored a careful dimensioning of the boiler under pressure and after pressure is removed, to determine if any alteration of shape occurs, or permanent set after pressure is removed.

The committee recommended, from their own experience, and from information gained from other sources, that boilers (locomotive) intended for ordinary pressures be tested, when new, to 180 lbs. hydraulic pressure by introducing hot water, and after the boiler is warm, so as to bring about uniform expansion, the pressure to be carefully applied and examination made to determine if any change of shape that would indicate weakness had occurred; also an examination of stays and braces after removal of pressure, to see if any weakness is developed, or undue strain is thrown on any members. If a new boiler would not stand a hot water pressure of 180 lbs. without movement of its parts or overstraining, they were of the opinion that it was not absolutely safe to stand the strains of service through its ordinary life.

For all subsequent tests, preceded by careful hammer tests, especially of stay-bolts, they recommended hot water hydraulic test, not less than 25 lbs. above boiler pressure. They considered a pressure test the only perfect one, as it reaches every point. Defects that might escape other methods would not escape this. They believed hot water sufficiently elastic to equalize the pressure, and that it would expose a leak better than steam. Inasmuch as the efficiency of any method depends upon its systematic application, they were constrained to recommend a periodical inspection every 12 months for the first two years of the life of a boiler, and thereafter every six months.

On motion, the following rules for testing boilers, in force by the Pennsylvania Railroad Company, were added to the report:

The boilers of *new* locomotives must be subjected to an hydraulic pressure of twenty-five (25) pounds per square inch above their rated working pressure before going into service.



NEW FILE HOLDER.

This test must be made once a year for the first two years, and thereafter every *six months.*

When boilers are being tested, the foreman of the machine shop having under his charge the repairs of locomotives, must attend personally, remaining outside, while an assistant examines the fire-box from the inside.

A record of all tests must be made, giving dates, and anything worthy of mention, which must be signed by the foreman and the person assisting.

The boiler must be heated to near the boiling point of water before the test is commenced.

Special examination of the *stay-bolts* of locomotives in service must be made not less frequently than *once every week.*

An inspector, specially trained for the service, must tap each stay-bolt from the fire-box side, and judge, from the sound, which of them are broken.

When these examinations are made there must not be less than thirty (30) pounds of steam pressure upon the boiler, which will produce sufficient strain upon the stay-bolts to cause the separation of the parts of broken ones. Should the boiler not be fired up, the examination may be made after drawing all the water from the boiler, in which case the vibration of the sheet after striking the bolt will indicate any unsoundness. The latter test is preferable, when it can be made without inconvenience.

He must keep an accurate record of the location of each imperfect bolt, and report the same to the master mechanic, who will decide, from the position of the bolts and the construction of the boiler, whether the locomotive must be withdrawn from the service.

No locomotive must be allowed to remain in service when there are one or more staybolts broken in the *top row.*

The dates of all tests of boilers and examination of staybolts must be given by the road foremen of engines on their monthly reports to this office.

Stationary boilers carrying 100 pounds' pressure per square inch, must be tested in accordance with the instructions given for locomotive boilers, including the examination of staybolts.

Stationary boilers carrying less than 100 pounds' pressure per square inch, must be subjected to an hydraulic pressure of fifty per cent. in excess of their rated pressure, once in every six months, and a special examination made of the staybolts both before and after the pressure has been applied, in the manner prescribed for the examination of the staybolts of locomotives.

Stationary boilers of odd types, such as those used over heating furnaces, must be tested the same as other stationary boilers, so far as the pressure and dates of test are concerned, and must be examined with reference to the particular construction of each boiler.

It must be understood that the foregoing rules apply to *all* boilers, whether located at the shops or at outlying points, and that they are in the direct charge of the master mechanic in whose district they may be placed.

The dates of all tests and examinations must be promptly reported to this office, giving also the general condition of the boilers and noting any staybolts or braces found to be broken.

DISCUSSION.

Mr. Blackwell (M. & W. Railroad) noticed that water was spoken of as being elastic. He would like to know to what extent warm water was elastic.

Mr. Sprague had assumed that if water expanded by heat, it was elastic. If it was not, he would ask that the statement to that effect be stricken from the report.

Mr. Stevens (L. L. S. & M. S. Railroad) asked how the Pennsylvania Railroad provided for testing staybolts, and testing boilers at outlying stations.

Mr. Shaver said men were provided to go to outlying stations. The instructions were to carry out the order.

Mr. Stevens argued that testing staybolts as often as once a week was unnecessary. Less than one-half of one per cent. of staybolts were found broken in one year in experiments that he made.

Mr. Whitney (Intercolonial Railroad), in reference to testing boilers every six months, asked if the Pennsylvania Railroad removed all the covering from the boiler.

Mr. Shaver said the general inspection was made when the engine was in the shop for repairs. They merely tested the boiler with pressure every six months, and examined the staybolts once a week.

Mr. Briggs (C. O. & S. W. Railroad) inquired how often the cylinder part of the boiler was tested.

Mr. Shaver said every time it was examined. When a locomotive was taken to the shop for renewing the jackets or flues, the boiler was thoroughly examined.

Mr. Briggs did not see how it was practicable to test a boiler every six months. He did not see how you could properly test a boiler without removing the flues. Making a rule to test a boiler at any time during the life of the flues would entail a loss that nine-tenths of the railroads could not stand.

Mr. Whitney said it was the custom on their road to examine the boilers thoroughly every time the engine came into the shop for general repairs. The tubes were taken out, the test applied, and a record kept of the time of the test and the pressure applied. Occasionally, when the engine was in service, the domes were taken off so that the inside of fire-box could be examined. Their domes were all over the fire-boxes. In twenty-five years' experience they had never found it necessary to test boilers as often as once in six months.

Other members spoke in favor of frequent tests of boilers.

Considerable comment is being made at the present time regarding the rupture of some steel boilers while under hydrostatic test in England recently. The facts of the case seem to be simply this: Some one tried to use a very fair article of *tool steel* for a boiler, and quite naturally failed. *Just* as naturally, in fact, as they would if they had tried to make a razor of Low Moor iron. Had specimens of the plate been properly tested by some one who knew the qualities required of boiler steel, it is quite likely the plates would have been rejected.—*The Locomotive.*

A company of robbers recently attempted to extinguish the electric lights in a cathedral, in Mexico, for the purpose of robbing those assembled. For this purpose the leader of the band threw a wire over the electric light wire, intending to pull it out of place; but by some mishap the electricity passed through his body, killing him instantly.

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NEW YORK, JULY 11, 1885.

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Work at the Master Mechanics' Convention.

The Association of Railway Master Mechanics at their eighteenth annual convention in Washington, June 16th, 17th and 18th accomplished much valuable work which will benefit not only the mechanical departments of railroads, but to a greater or less extent the mechanical public at large. It is not strictly correct to say that the work was accomplished in the three days during which the Convention held its sessions, for the committees who presented reports had been gathering material to embody in them for a whole year. By sending out circulars of inquiry, and by untiring correspondence the members of the several committees collected facts to make their reports valuable. The regular reports presented were: On Boiler Construction; Improvements in Locomotive Valve Gears; New Plans for Construction and Improvement in Locomotives; Steel Castings for Locomotives; The Testing of Boilers by Hydrostatic Pressure; On Smoke Stacks and Spark Arresters. The committees appointed last year on driving wheel brakes and on shop tools did not have reports ready to present. The Secretary required nearly an hour to read the boiler report, which was afterwards discussed in sections. Besides discussing every report, topics were suggested by members on two or three occasions which elicited considerable practical information. The question as to the efficiency of special traction-increasers, constructed so as to throw part of the weight of the tank upon locomotive driving wheels when required, developed adverse views. Some had found the device to gain traction, others with equally careful experimenting could discover no good in it whatever. The question was not settled, neither side being able to convince the other. Another question which has recently caused a ripple of interest in railroad circles was disposed of very positively. It was that relating to the reliability of steel for fire-boxes. One member only had discarded steel for this purpose and had gone back to iron. His road is a very short one and has a few switching engines. The experiences of the other members with iron and steel for fire-boxes was decidedly favorable to the latter, and a resolution was adopted unanimously that "it is the sense of this convention that steel is the proper material for fire-boxes." The members showed their liberality and disposision to welcome all efforts toward mechanical progress by inviting two men who do not belong to the association to present papers at the convention. The master mechanics have been accused of being too conservative, but this view seems to arise from the necessity of their proving the value of every innovation before adopting it in regular practice. Certainly no society of mechanics or engineers is more ready to give attention to anything that promises to be an improvement, and when its merits become known, to give it due recognition.

A venerable member, Isaac Dripps, transmitted to the association some drawings of a boiler made in 1835. It was brought out in discussion that there are lots of new inventions springing up every day upon which patents are granted that are represented by old drawings like that of the boiler. The presentation of details of old devices will have a tendency to choke off a great many of these so-called new inventions. Incidentally it was brought before the convention that it has been decided to construct an annex to the National Museum in Washington in which shall be placed relics in regard to the early railway history of America. Material was solicited on the part of the museum management to make the collection a full one.

A committee of five was appointed to consider and confer with a similar committee of the Franklin Institute looking to the weighing of the hammer blow, at the coming "Novelties" Exhibition of the Institute. Should such a test for any cause fail to be made, the committee shall refer the data obtained to the committee on subjects to be considered at the next annual meeting.

The Committee on Valve Gears, in summing up the matter in their report, advanced the opinion that, although several experiments have been tried, "no material change which can be pronounced an improvement has been made in this country to the ordinary valve motion of locomotives."

The report on steel castings for locomotives, which we published last week, and the discussion thereon, which appears in this issue, will be read with special interest. It will be noticed that the general experience has been that cast steel crossheads do not wear as well as those of cast iron. Steel castings, however, are being adapted to locomotive requirements, and the opinion was freely expressed that they will supplant other metals for some parts.

Consideration of the question of drilling *vs.* punching boiler plates, brought out the fact that formerly most of the members advocated the drilling of sheets, but that the majority of them have quietly gone back to punching. The opinion seemed to prevail that it is not necessary to drill holes in open-hearth steel, but where crucible steel is used drilling is necessary. But crucible steel plates are not much used. Punching saves time and expense.

The subjects for committee reports at next annual convention (to be held in Boston, third Tuesday in June, 1886,) are: Boilers—Improvement in Construction; Standard Driving Wheel Center and Standard Section of Tire; Driving Wheel Brakes—To what Extent is their Use Advisable, and the Best Mode of Application? Balance Slide Valves; Best Material and Form of Construction for Locomotive Guides and Crossheads; Best Plan of Cleaning, Removing, and Resetting Tubes; Shop Tools and Machinery.

The Association is continuing its work in the direction of standards. It has already accomplished much, and more remains to be done. The suggestion of the active and progressive new president, Mr. J. Davis Barnett, that when master mechanics can more definitely declare their wants, manufacturers will be better enabled to supply them, will be acted upon in the work of the coming year.

Every mechanic, no matter of what class, should learn to read, if not to make, drawings, if for no other reason than because their language is universal. One may take up a foreign engineering book or periodical, the printed language of which he cannot read a word, and, perhaps, by his knowledge of reading drawings, be able to get valuable information from it.

About the most encouraging incident in the manufacturing and business situation, is the settlement of the iron workers' wages scale in Pittsburgh and the West. While the lockout lasted, about $150,000 a day was cut off from circulation, and the effect could not have been otherwise than depressing. What makes the agreement on the wages question more encouraging to the general business public, is the fact that the rate asked by the workmen was conceded instead of insisting upon the lower rate offered at first by the manufacturers. This shows that the iron trade is far from being in a state of hopeless depression. Most of the mills start up with a supply of orders on hand, and the outlook has decidedly improved within two weeks.

We publish elsewhere a communication from a boilermaker, which is worthy the attention of every young member of that craft, as indicating a move in the right direction. Many boilermakers, excellent workmen, miss opportunities to better themselves through a lack of knowledge of laying out work, which knowledge can be gained by just the means our correspondent tells about. The more such clubs are organized, the less poor boiler work there will be to complain about. No one who perseveres in a course of the kind indicated will fail to learn what he starts out to learn, and will learn many things never thought of at the beginning. Such a course is the best school in the world. The AMERICAN MACHINIST wishes every movement of this kind the greatest possible success.

According to a table of comparative cost of the chief commodities in use by the people of this country, liquor comes first, tobacco second, bread third, meat fourth, iron and steel fifth, and woolen goods sixth. This does not look well for the temperance reformers. The expenses for rum are greater than the expenses for railroads every year.

Pittsburgh is considerably puffed up with natural gas just now. By the first of July it is expected that about every iron and steel mill will be using natural gas as a fuel. This will be hard on the coal miners and those handling coal in transportation and in the mills, but the gas wells will not flow forever. Of course natural gas is cheaper than coal, and it is good policy to make iron and steel with gas while the flow lasts.

A Western machinery establishment writes us to obtain a copy of well arranged indenture papers for apprentices. We should be obliged to any establishment having forms of indenture papers, to send us a copy. There are many others who would like to have a copy, and the best way is to publish two or more forms in the AMERICAN MACHINIST.

Hubward the star of mechanical societies takes its way. Three of the leading national mechanical associations have decided to hold their next annual meetings in Boston. The American Society of Mechanical Engineers will meet there next November, and the Master Car Builders and the Master Mechanics will both meet there next June. The members of these societies know that their convention work will be appreciated at the Hub, that each society will be well received as a body, and that every member can find first-class hotel accommodations while he remains in the city. Nor is there any scarcity of other attractions to make their stay agreeable. As much cannot be said of every place where these associations have met.

The little steam yacht Stiletto, built by the Herreshoff Company, of Bristol, Conn., has awakened a good deal of comment by beating (so it is claimed) the Mary Powell. There is nothing, perhaps, very remarkable in this, as the latter boat was on regular service; but without doubt the Stiletto is a fast boat, having great engine power for her size. She is 90 feet long on the water line, and 11 feet beam; engine, compound surface condensing, with cylinders 12″ and 21″ diameter and 12″ stroke. The boiler is sectional water tube, the tubes being arranged horizontally in sets; the boiler differs in arrangement, but not in principle, from the regular Herreshoff boiler. It is designed for a steam pressure of 160 lbs.

Since our publication, in a recent issue, of letters from over fifty machine-tool builders giving their amount of taper for lathe spindles and drills, we have received a few more. The only noticeable difference from the tapers already published is that of the Ames Manufacturing Co., of Chicopee, Mass., which is $\frac{3}{8}$″ per foot, both for drills and lathes. Despite the manifest advantages of having a standard and uniform taper, we see little prospects of one being adopted by tool builders.

"The Inventors' Club" has been formed in Detroit, to advance mechanical science and draw out inventive genius. They propose to mention some useful mechanical device for competition, and will give $50 for the best design of the article they shall mention. W. N. O'Day, 157 Spence St., Detroit, is secretary. Inventors of rotary engines, car couplers, churns, automatic wheelbarrows and the like, should each enclose a stamp when they write for particulars, or they won't get an answer.

The troubles of the Dolphin are being well ventilated. Bad construction, as well as bad design, is charged by the Examining Board. John Roach is now constructing the three cruisers, the Boston, Atlanta and Chicago.

Prof. Thurston Takes a New Position.

At the close of the present college year Prof. Thurston retires from the faculty of the Stevens Institute of Technology, to accept a position at Cornell University as presiding officer in the newly organized Sibley College, the school of Mechanical Engineering and of Mechanic Arts, the scope of which has recently been greatly enlarged, and which has been provided with new buildings and large accessions to its collections and workshops. It is not yet announced who will succeed Prof. Thurston at the Stevens Institute, but it is expected that the new Professor of Engineering at the latter school will be a gentleman standing very high in the ranks of his profession, of distinguished ability, of large practical experience, and very sucessful as a writer upon subjects relating to the theory and practice of engineering. Sibley College is to be congratulated upon securing such an able and efficient presiding officer.

Production of Metals.

The Department of the Interior sends out advance sheets of a volume entitled: "The Mineral Resources of the United States, 1883 and 1884," now in press. The metallic products of the United States in 1883 amounted to $203,116,859, and in 1884 to $186,097,599. The falling off was mainly in value of pig iron, which declined from $91,910,200 to $73,761,524. The production in long tons, however, fell only from 4 595,510 to 4,097,868 tons. The price declined more than the production. The gold production increased from 1,451,249 to 1,489,949 troy ounces. As gold is taken as the standard by which all other values are measured, there was no decline in the price of itself. Silver came up from 35,733,622 to 37,744,605 troy ounces. More than half the silver was used for coining standard dollars. If this coinage were to be stopped the next statistics of production would probably show a great falling off both in quantity and in value per ounce. About two years ago considerable excitement was created by the reported discovery of a new and cheap process to reduce aluminum, and a company was formed which it was claimed would soon produce it in large quntities. According to the official statistics before us 1,000 troy ounces of aluminum were produced in 1883, and 1800 ounces in 1884. The value of the latter quantity is $1,350 at Philadelphia. Copper rose from 117,151,795 pounds to 145,221,934 pounds, but the value of the copper "crop" fell from $18,064,807 to $17,789,687. Nickel followed about the same course as copper. Its product increased from 58,800 lbs. to 64,550 lbs., but the value fell from $52 920 to $48,412. Notwithstanding the above tumble in prices, we have not heard of any Solon of finance who proposes to make a raid upon Congress to increase the weight of cents and five-cent coins.

Literary Notes.

The *Bolt*, for 1885, published by the students of the Stevens Institute of Technology, is a lively magazine. Artistically, classically and typographically it comes up to the mark. The choicest productions in the way of technical humor are dressed up in approved style. The business end has not been lost to view, as 55 pages of advertising grace the publication before us. The boys evidently acquire business ideas while at Stevens.

Candles to the Front.

The candle furnished the earliest light of which men living at the present day have much knowledge. Years ago the candle was superseded by the lamp for burning animal oil, which in turn was displaced by gas and by kerosene. Latterly these have been hard crowded by the electric light. On the principle that what follows is the best, there would not seem to be any room for the ancient candle; but, as if to show that such logic cannot be depended upon, English engineering and trade journals are giving generous space to illustrating and describing a somewhat complicated machine for making candles. Perhaps the cycle is complete, and about to be repeated.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(206) W. W. H., Ensival, Belgium, asks: What is the proper number of teeth for milling cutters from 1" to 6" diameter? *A.*—There is great difference in practice in this respect. For ordinary purposes six teeth to the inch of diameter is, perhaps, about average practice.

(207) A. B., New York, asks questions about size of shafts, belts and pulleys, but fails to give speeds. Without knowing full particulars his questions cannot be answered.

(208) H. J. O., Toronto, Ont., asks: Will you tell me what kind of steel to use for magnets, and if it should be tempered, and if so, how hard? Also if there is a kind of steel called magnet steel? *A.*—Use crucible cast steel, tempered to a high spring temper. We do not know of any steel called magnet steel.

(209) W. H., ——, asks: 1. Can you give me a rule for finding the amount of iron that should be used in the rim of a high-speed engine with about 40 lbs. mean effective pressure; also dimensions of arms and hubs? *A.*—For weight of fly-wheels, see AMERICAN MACHINIST, May 13, 1882. For pulley dimensions, see AMERICAN MACHINIST, July 23, 1881.

(210) W.A. K., Dartford, Ont., writes: 1. Have a horizontal marine engine, 2¾"×4", with link motion: I cannot get it to take steam even at both ends. I can get it right at one end, but at the other end it commences to take steam before it gets to the dead center. I shifted the eccentric, then the end that was right was wrong; also when I hook up the lever she does not take steam evenly. How can I remedy this? *A.*—Shifting your eccentric, as you speak of, would not equalize the lead; it will increase or decrease the lead, according as it is moved forward or back. To make the lead equal at both ends you should shorten or lengthen the valve stem connection, then, having got the lead equalized, make it more or less by shifting the eccentric. We can't tell what causes your other trouble without personal inspection. 2. How can I get a long blast from my whistle? The pipe is from top of dome, but after valve is open for a short time water passes through to the whistle. *A.*—You are probably trying to use a whistle too large for the boiler. You may be able to help it some by putting a plate of iron in the dome, just under the entrance of the pipe. 3. Where is the *Locomotive Engineers' Journal* published? *A.*—Cleveland, Ohio.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Curtis Pressure Regulator and St'm Trap, July 4, p 15

Edw. Sears, wood engraver, 48 Beekman, St., N.Y

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Tools for amateur and foot-power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N.J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

We will close at forced sale twist drills, taps, etc.; order early. York & Burton, Cleveland, O.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

Improved Labor-Saving Upright Drills. B. G. & S. F.; prices reasonable. Currier & Snyder, Worcester, Mass.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co, 62 Chatham St., N. Y.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co, 32 Frankfort Street, N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught," $4. Books for workmen Joshua Rose, Box 3306, New York City.

Morrison's Practical Engineer, a complete treatise on steam and general machinery. Price, $1; mailed free. Indicators, Engineers' Instruments and outfits. W. A. Morrison, Box 373, Lowell, Mass

Locomotive Engine Running and Management. By Angus Sinclair. Price $2. An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES.

Edward Kelley is erecting a boiler shop in Fall River, Mass.

A. E. Merrill & Bro., are preparing to enlarge their shops at Jacksonville, Fla.

A plan is on foot to start a co-operative rolling-mill at Irondale, Jefferson County, Ohio.

D. E. Whiton will build a machine shop at New London, Conn., 102x72, with a wing 20x30 feet.

Gleason & Baily, of Seneca Falls, N.Y., will erect a factory for the manufacture of fire apparatus

Claflin, Colburn & Co., of Boston, will rebuild their boot factory, recently burned, at South Framingham.

The tin factory of John Q. Smith, Clinton Street, Syracuse, N. Y., lately burned, will be rebuilt and equipped with new machinery.

A roundhouse and machine shop are being built at Walnut, Texas, for the Texas Central Railroad. —*Baltimore Manufacturers' Record.*

The Hewitt Manufacturing Co., manufacturers of journal bearings, of Chicago, will erect a two-story shop, 50x80. A. B. Pullman is President.

About 200 men will be idle at Port Huron, Mich., for two or three weeks, on account of the temporary closing of the Grand Trunk Railway Shops.

Among the rewards received at the New Orleans Exposition were three medals to Gould & Eberhardt, of Newark, N. J., for their machine tools.

The Williamson Iron Co., has been incorporated in Birmingham, Ala., by C. P. Williamson and J. B. Simpson, to erect an iron furnace; capital stock, $150,000.

The Rochester Car Wheel Company's Works, at Rochester, N. Y., are to be removed to E. Rochester, as soon as the necessary buildings can be erected.

The Frontier Iron and Brass Works, Detroit, Mich., have been in business for some years. The company has just been incorporated, with $150,000 capital.

Frank Ellis, late machinist at the Scovill Manufacturing Company's works at Waterbury, Conn., has accepted a position in a factory at Baltimore, at a yearly salary of $3,000.

The National Wire and Iron Co., of Detroit, Mich., have leased the old Stephen Pratt boiler works building adjoining their works, purposing to use it for heavy iron work.

Sotter Bros., steam boiler manufacturers, of Pottstown, have secured a contract to construct for Henry S. Eckert & Bro., of Reading, Pa., iron manufacturers, twelve large boilers.

The Co-operative Stove Company, of Buffalo, N. Y., are busy. Besides making all the castings for the Hubbell Stove Co., they are assisting the Co-operative Foundry Co, of Rochester.

B. B. Butt, 459 Broad Street, Newark, N. J., whose right-angled level we recently illustrated, wishes it understood that he is not manufacturing the instruments, but is looking for a manufacturer.

The Torrington Manufacturing Company, Torrington, Conn., will commence the manufacture of brass upholstery nails. They have leased a building and will put in a 50 horse-power engine.

The Dodge Railroad Stand Pipe Company, of Niles, Mich., announce by circular that they have sold their entire business of making stand pipes to the Sheffield Velocipede Company, of Three Rivers, Mich.

T. R. Almond, 83 and 85 Washington Street, Brooklyn, N. Y., built a new design of speed lathe for his own use. It worked so well that several others who saw it, ordered lathes like it He will endeavor to supply the demand.

A. Aller, 109 Liberty Street, New York, has issued a catalogue of Buffalo steam pumps for all purposes. The pumps are mostly of the duplex variety. Catalogue, with prices, will be mailed upon application.

Hiram Thompson, Worcester, Mass., has issued an illustrated catalogue of iron and wood-working machinery made by him. He makes upright drills tenon machines,, saw tables, wood-turning lathes and foot mortisers.

The Aultman Engine Co., of Des Moines, Iowa, are now building new works, 66×132 feet, three stories in height, and expect to occupy them in about 60 days with entirely new machinery and largely increased capacity for their line of manufacture.

H. C. Heckerdorn, Reading, Pa., writes us: "I am now preparing the drawings for six sizes of engine lathes (of new design), which I am about to manufacture, and I expect in all of these sizes to use tapers that will interchange with those of Brown & Sharpe's make."

Sebastian May & Co, Cincinnati, Ohio, have issued an illustrated catalogue and price list of foot and power lathes, drill presses, chucks, drills, and machinists and amateurs' supplies; also two and four horse-power engines. The catalogue will be sent by mail upon application.

Novel machinery for the rolling of thread instead of cutting it on bolts is being erected at the Reading Bolt and Nut Works, on North Third Street, Reading, Pa. Other new machinery for the making of thread in the nuts so as to correspond with the thread of the bolts is also being placed in the mill.

The Chicago, Burlington & Quincy Railroad has just ordered $26,000 worth of new machinery for their shops at Plattsmouth, Neb. They will have a new B. & S. Universal milling machine, a radial drill, a Niles wheel lathe, a horizontal boring mill, a twist drill, grinding machine, two small lathes, a planer, a quartering machine, and a 42" lathe, for Pullman wheels.

The Walker Manufacturing Company, Cleveland, Ohio, have published a new illustrated price-list of pulleys, shafting and hangers made by them, accompanied by a circular of Walkers' traveling cranes and Millers' Rumbling Mill. They also make machine-moulded gears, ball and socket bearings, band wheels, grooved wheels, couplings, patterns, and a line of foundry equipment. They make pulleys from 6" to 60" diameter Their facilities for either castings or finished work are excellent.

Many instances have been published of long runs made by locomotives, but not much about the long runs of stationary engines. The Westinghouse engines have lately presented two instances. One is that of the Fulton Municipal Gas Company, of Brooklyn, who have two engines of 40 H.P., each of which run six weeks at a time continuously. Lombard, Ayeres & Co., the oil refiners at Bayonne N. J., have a 60 H.P. Westinghouse automatic engine driving a fan, which was started some time last November, and has made 320 revolutions each and every minute without a let up, days and Sundays, up to date. Mr Leman, the superintendent, says that unless his belt laces bother him, he won't shut down till the spring of '86, say about 252,288,000 revolutions, "be the same more or less"

The Cummer Engine Co., of Cleveland, Ohio, have recently received orders for 170, 70, 100, and 130 H.P. outfits complete, for the Harney Peak Mining Co., of New York, Volney Q Irwin, of Crawfordsville, Ind., Temple Pump Co, of Chicago, and the Forest City Carbon Co., of Cleveland, O., respectively. In each instance the competition was very close. They have also just shipped a 170 H.P. engine to the Lowell Mfg. Co., of Lowell, Mass., and have a 105 H P. engine about ready to ship to W. Kautsky, of Indianapolis. Their sales for the Jonathan Mills Reel are still on the increase, and now run up all the way to ten per day. Their orders, we learn, are coming in from all directions, and are promptly filled. They started up a number of their Ballantine refrigerating machines this season in breweries in different sections of the country, and in every instance the machines are said to be giving the best of satisfaction.

A Newark (O.) dispatch says: "The Newark Machine Co. put a force of men to work to remove the buildings and property formerly occupied by them, but burned about a year ago, but they were immediately stopped by the city officers. The company removed here from Hagerstown, Md., in 1882, and secured a bonus of $35,000 from the city, and entered into a contract to build their works here and employ 100 or more men for the period of ten years. They continued in successful operation until July last, when they were burned out. They removed their works temporarily to Columbus, and the officials of that place offered them great inducements to get them to permanently locate in that city. Ever since then the officials of this place have been trying to get some definite understanding as to their rebuilding their works here. The officers of the company wanted $50,000 more and a release of the old mortgage of the $35,000 bonus, and also for the city to agree to build water works immediately, but they met with such strong opposition that they soon withdrew their demand. The city held insurance on the buildings to the amount of $20,000, and suit has been brought against the insurance companies to recover it."

It is reported the Maine Central Railroad will erect new shops at Waterville, Me.

There is some talk of a steel plant in the vicinity of Neshannock Furnace, New Castle, Pa.

A contract for 500 box and flat cars for an Eastern railway has just been booked by the United States Rolling Stock Company, at Hegewisch, near Chicago, Ill.

The *Iron Age* devotes two columns to "The Causes of the Manufacturers' Defeat." It charges that some of the iron manufacturers kept bad faith with the others, which was the main cause of defeat. The workmen trusted each other. Yet the same paper has contended that co-operative ventures are not likely to succeed because the workmen do not have confidence in each other.

Machinists' Supplies and Iron.

NEW YORK, June 25, 1885.

Business in supplies is easy and uneventful, without prospect of change in the near future. As consumers keep nothing on hand, there cannot be much falling off of trade during the warm months.

Manufacturers report no general change, and seem to have settled down to meet the demands, and, in some instances, are accumulating some stock.

Iron—There are no important changes in prices of American pig. The virtual ending of the strike of iron-workers was looked upon by pig iron makers as opening up a little better prospect, but the effect is scarcely felt. Furnaces will not be likely to accumulate stock, and buyers will not buy except for immediate needs. We quote No. 1 Foundry $18; No. 2 Foundry $17, for favorite brands; other brands have sold for $17.50 and $16.50 respectively; Grey Forge, at furnace, $14 to $15.

Scotch Pig has ruled dull. Only small lots are sold at prices favoring buyers. We quote Shotts, $20 to $20.50; Coltness, $20 to $20.50; Gartsherrie, $20; Summerlee, $20; Carnbroe, $18.50 to $19; Eglinton, $17.50 to $18; Langloan, $20 to $20.50; Dalmellington, $18.50 to $19.

Copper has been in very moderate demand, with hardly business enough to establish prices. Lake is held at 11½c.; other brands 10½c. to 10¾c.

Lead is held at 3.90c. to 4c., but consumers are not disposed to pay these prices, and the increase may be abandoned at any time.

Spelter—Refined, 8c. to 8¾c.

Tin—The market does not appear to be seriously affected by the attempted corner in London. Banca has sold, in jobbing lots, at 21½c.; Straits and Malacca, 21½c. to 21⅝c.

Antimony—Hallett's, 9½c.; Cookson's, 9½c.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Situation as foreman or superintendent of machine shop. Lock Box 568, Philadelphia, Pa.

A thoroughly practical mech. engineer, designer and draftsman is open for engagement; specialty, steam engineering; also well posted in other lines. Address U, AM. MACHINIST.

Wanted—By an experienced German wire nail maker, to join some party to start the manufacture of all kinds of wire nails and wire tacks. Address "Wire Nail," AM. MACHINIST.

Wanted—Situation by first-class pattern-maker, experienced in gearing, machinery, engine and mill work; is good draftsman and capable foreman; highest references. Address Box 3, AM. MACHINIST.

Foreman wanted for an establishment manufacturing childrens' wagons and sleighs, also cabinet work; must understand wood-working machinery. Address, with references, P. O. Box 1233, Montreal, Canada, stating wages expected.

Wanted—Competent man to superintend construction of printing machinery and take charge of drafting-room. Must have had experience in above line. Address, stating age, experience, education and expectations, "Press," AM. MACHINIST.

Wanted—A thorough mechanical engineer and draftsman who has had experience in designing stationary and marine engines; must have good technical and practical training. Address Strong Locomotive Engineering Co., 701 Chestnut Street, Philadelphia, Pa.

Toolmaker wants situation to take charge of screw machine; competent to design and build tools for any class screw machine work; 15 years' experience on gunand sewing mach. tools; good manager of help; first-class refs. Address Asquith, care of Geo. F. Connor, Bridgeport, Conn.

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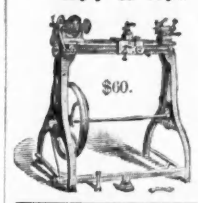

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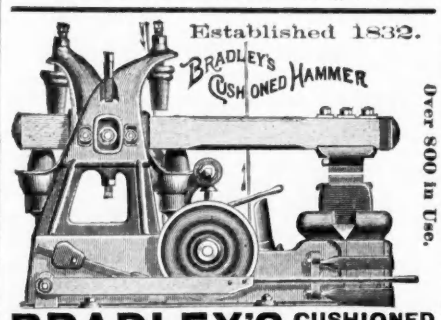

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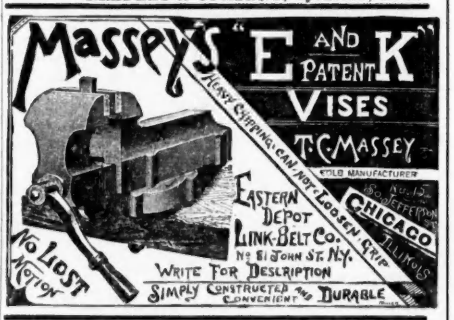

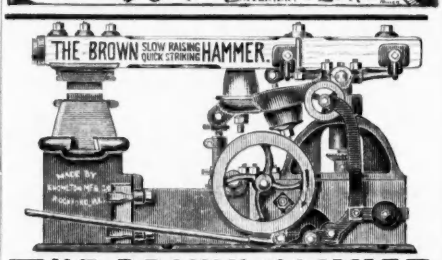

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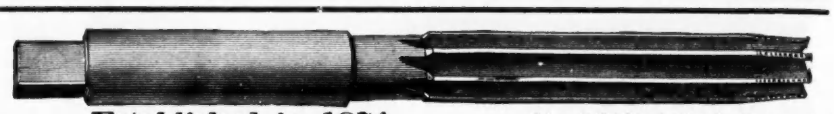
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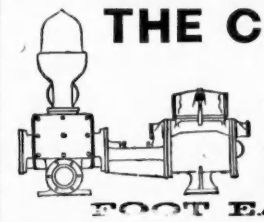

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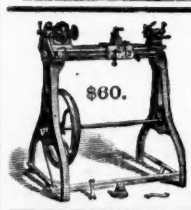

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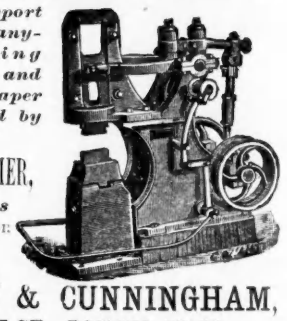
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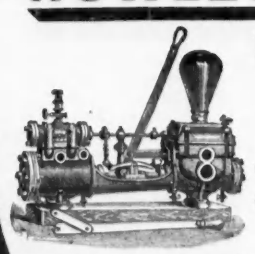
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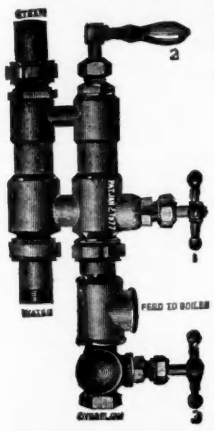

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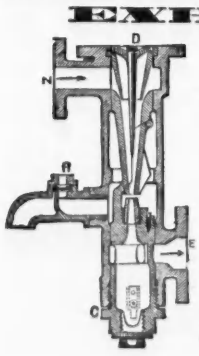

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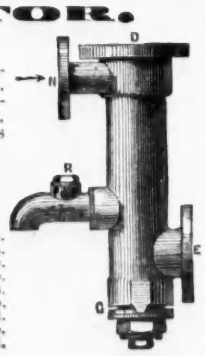

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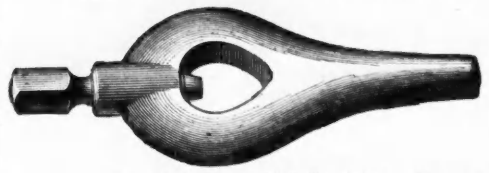

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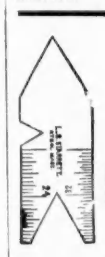

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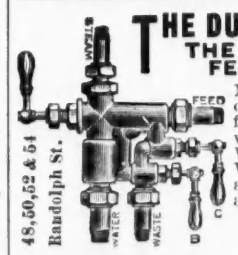

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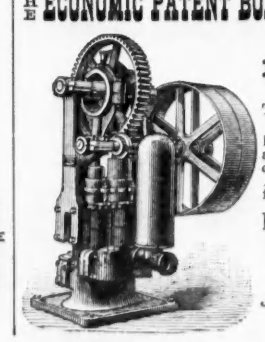

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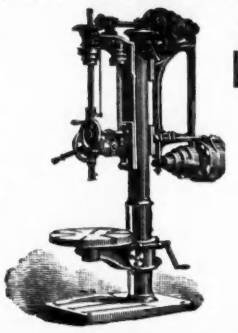

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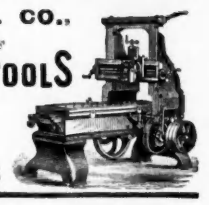

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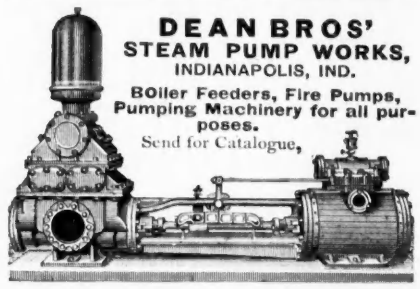

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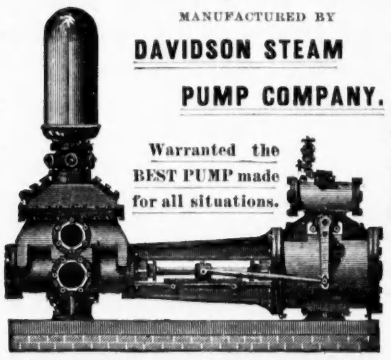

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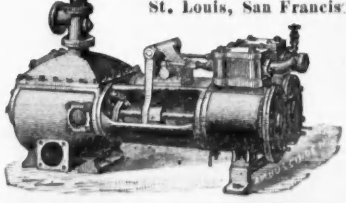

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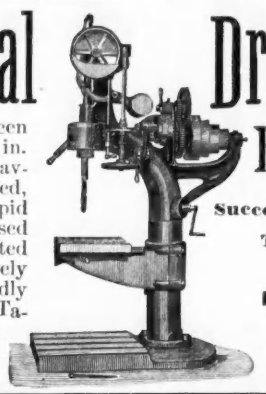

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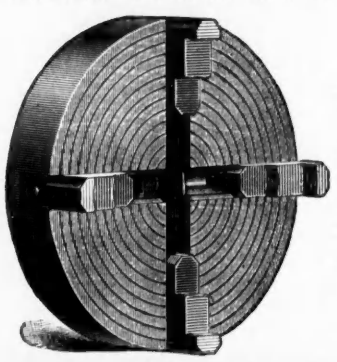

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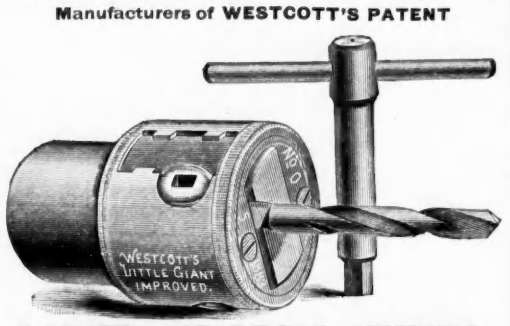

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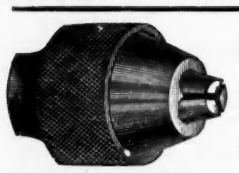

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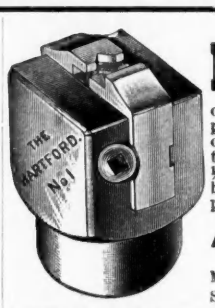

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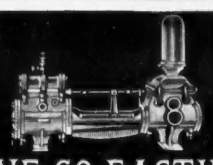

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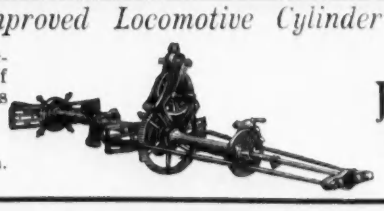

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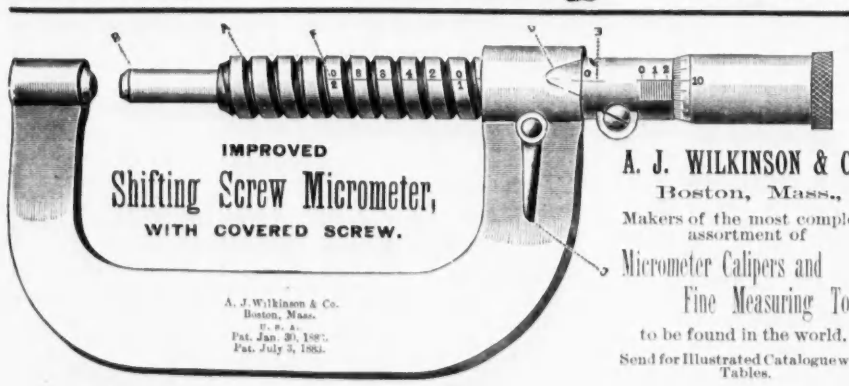

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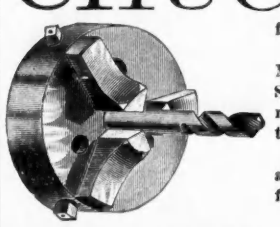

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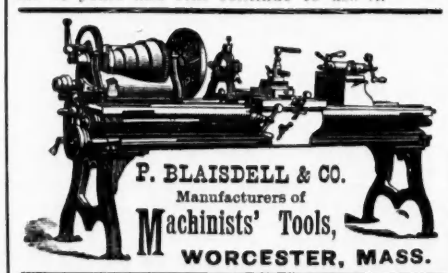

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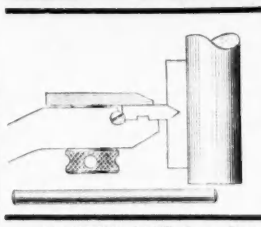

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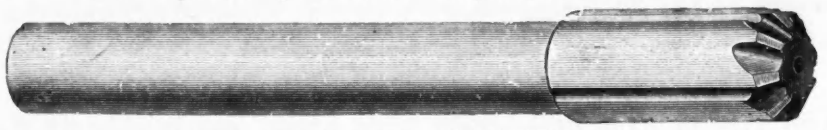

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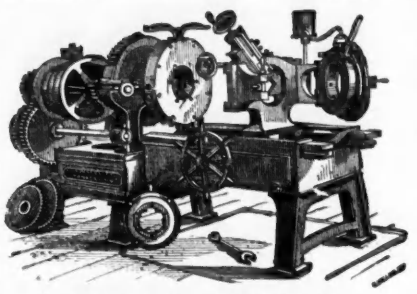

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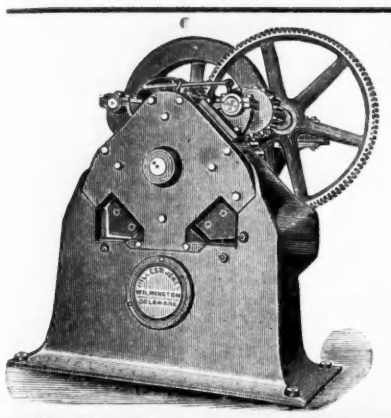

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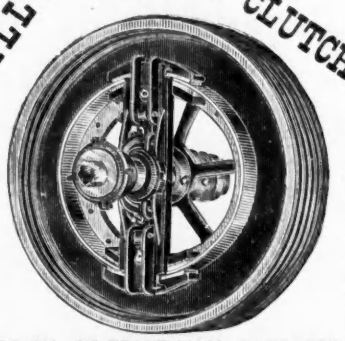

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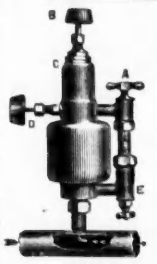

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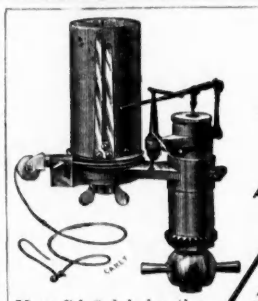

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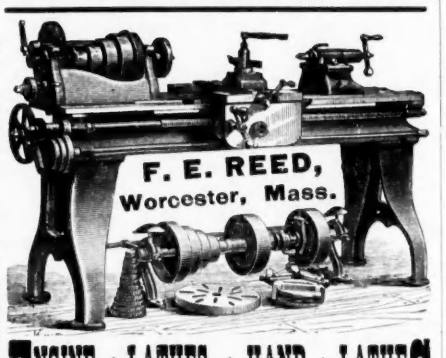

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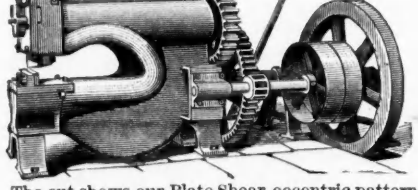

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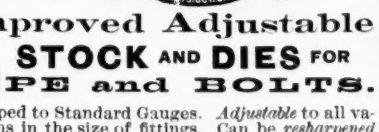

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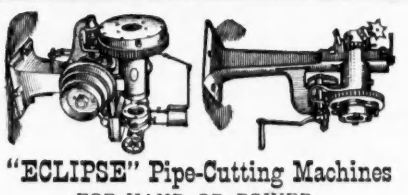

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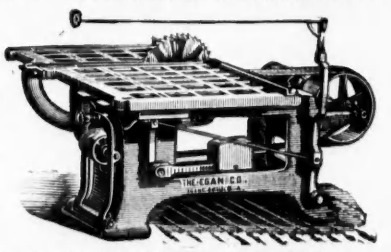

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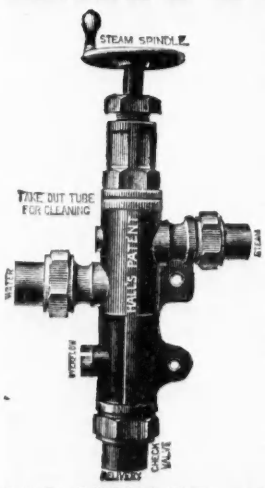

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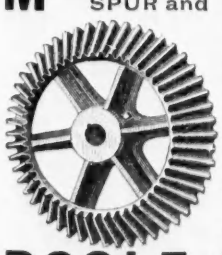

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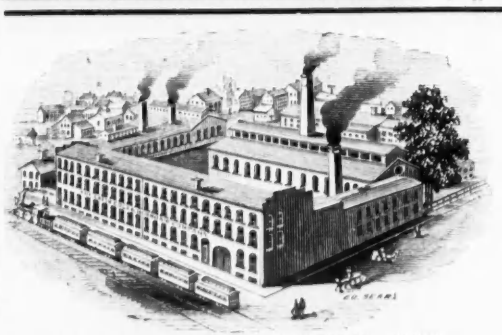

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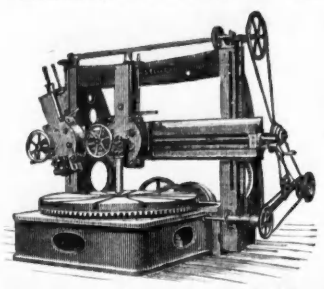

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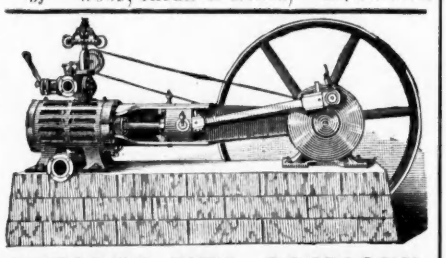

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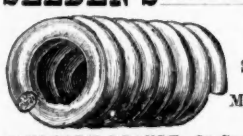

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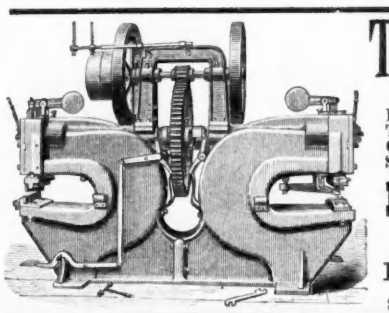

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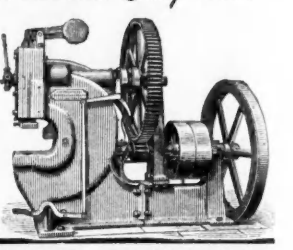

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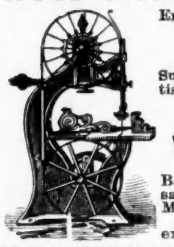

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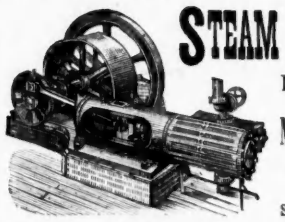

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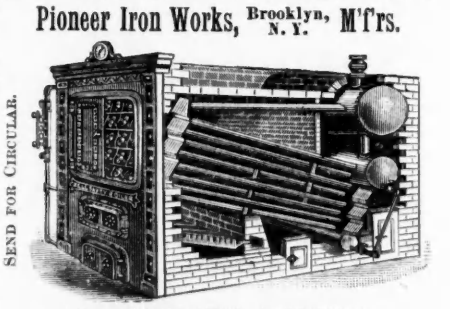

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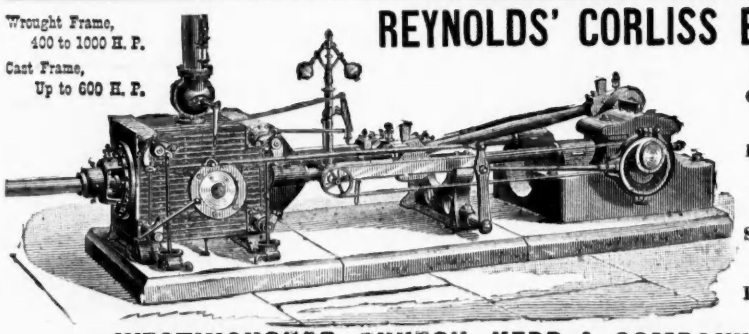

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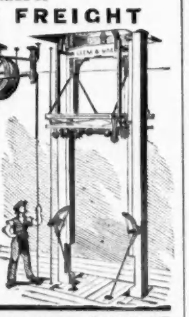

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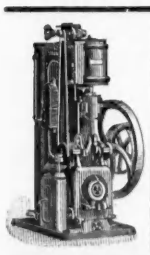

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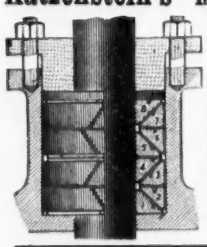

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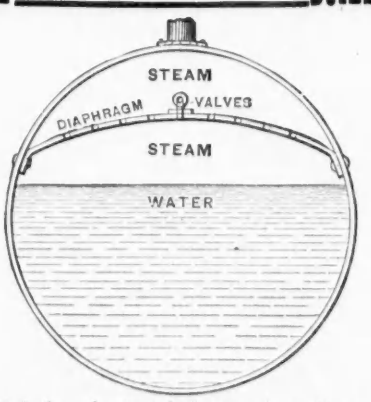

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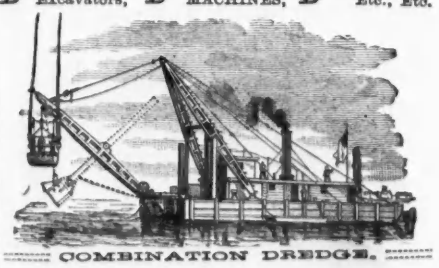

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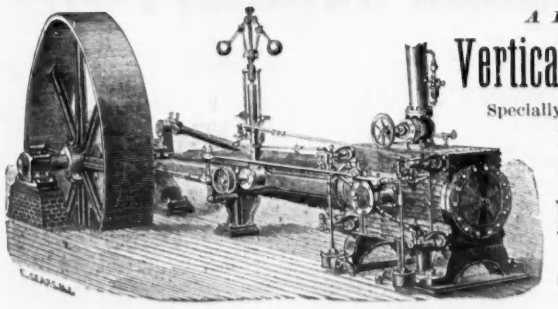

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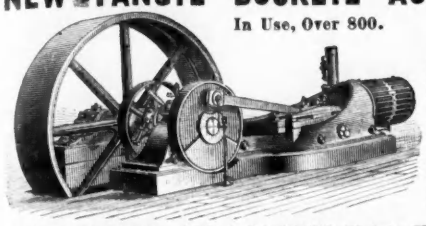

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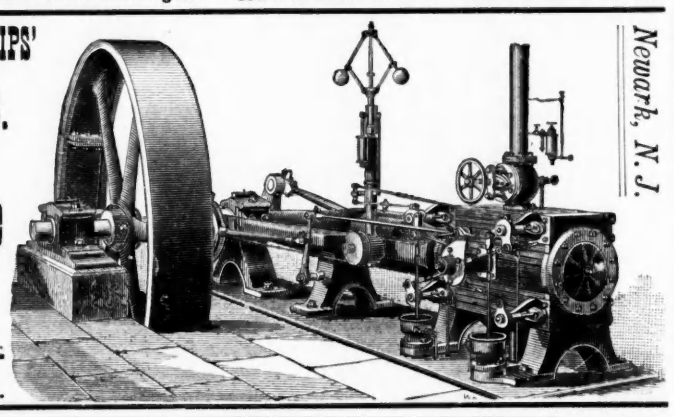

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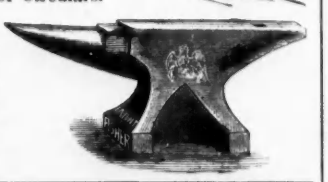

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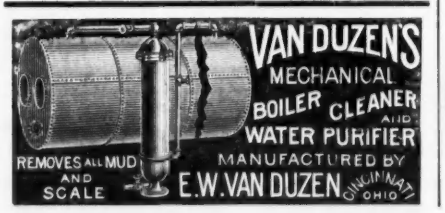

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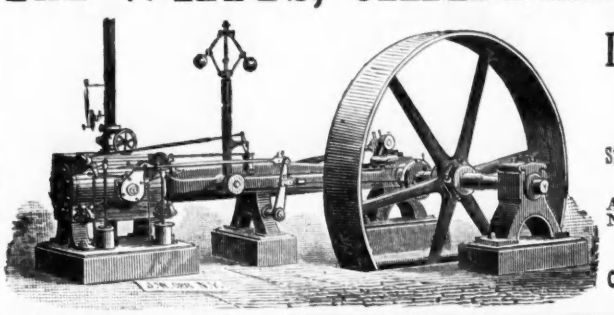

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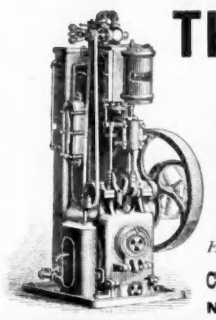

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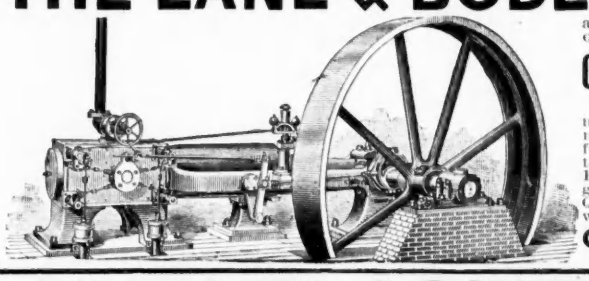

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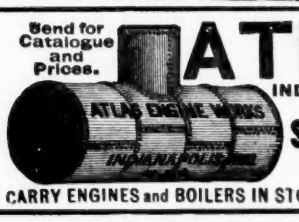

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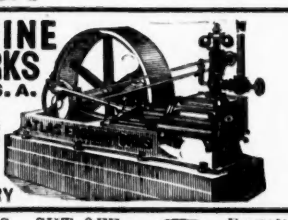

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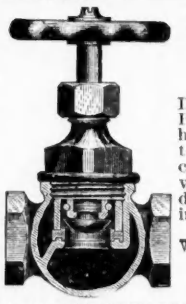

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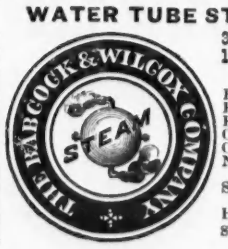

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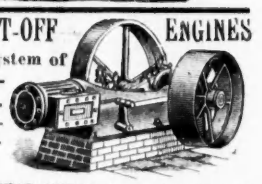

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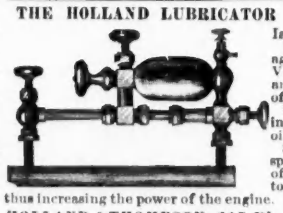

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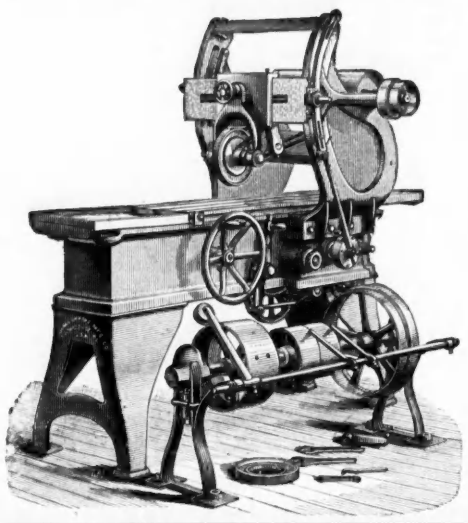

This machine is designed for flat and true surface grinding and finishing. It is an effective substitute for the operations of filing and stoning. The entire cost of files and three-quarters of the labor usually expended on these operations is saved, beside obtaining better surfaces upon the work done. For all finished parts of machinery of cast iron or steel, hard or soft, for punches and dies, straight edges, flattening dies, &c., it will prove invaluable, and will produce fine work by the use of low-priced labor. It will grind 14 inches wide, 36 inches long, 13⅛ inches high, using a 12-inch wheel. Countershaft should run 270 turns per minute. Tight and loose pulleys 8 inches diameter, 4 inches face. Weight of machine complete. 2200 lbs.

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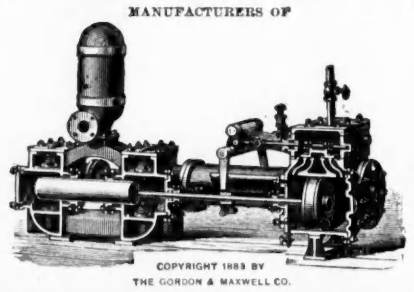

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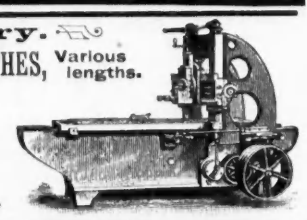

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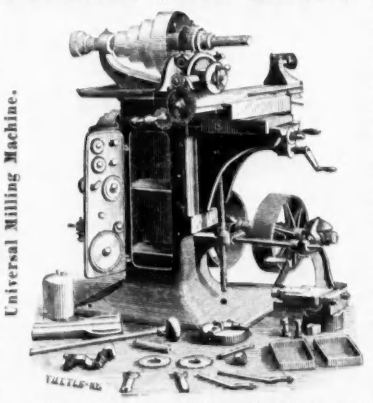

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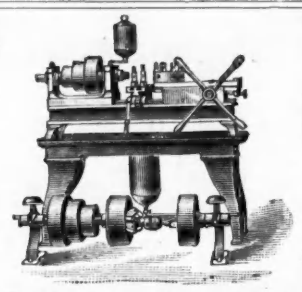

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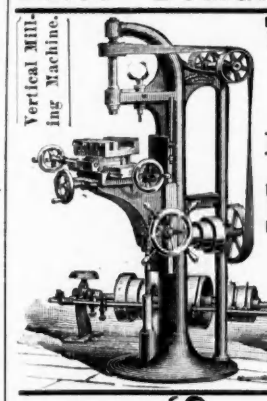

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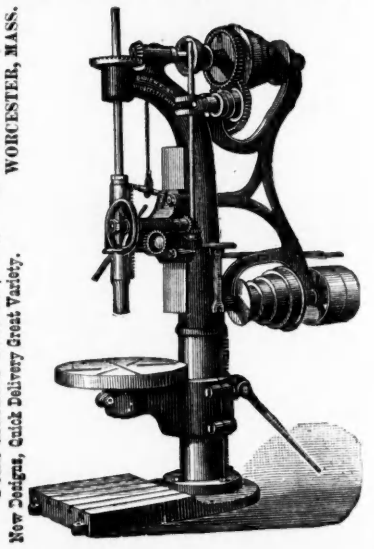

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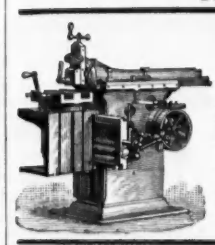

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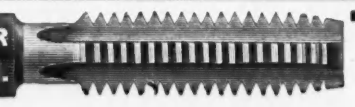

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